Lawson Insight on OS/390 Installation Experiences

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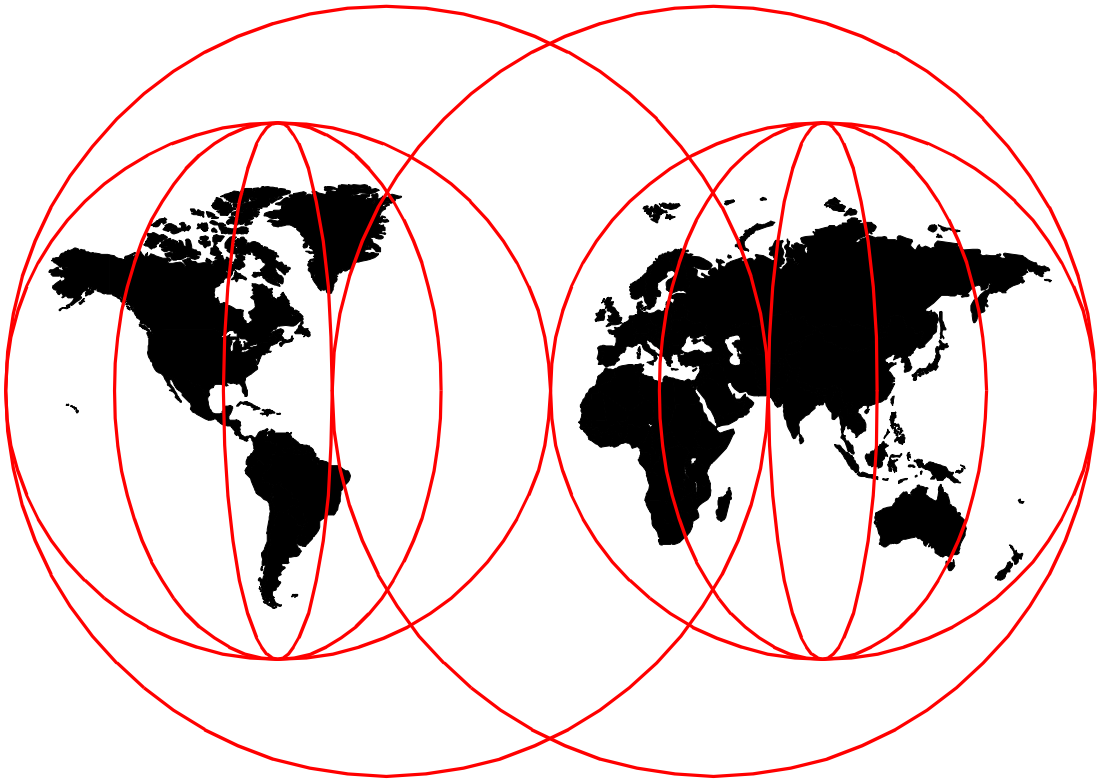

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Lawson Insight on OS/390 Installation Experiences

May 2000

Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix K, “Special notices” on page 115.

First Edition (May 2000)

This edition applies to Lawson Insight with DB2 V6 and OS/390 Release 2.8. with Lawson Insight 7.3.2.

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Preface

This redbook will help you install and customize Lawson Insight Applications for OS/390 Release 2.8 with DB2 V6. It is based on the installation experiences gained while installing Lawson Insight Applications with DB2 V6 for use with OS/390 V2R8 at the ITSO in Poughkeepsie.

It contains an introduction to the architecture of the Lawson Applications for OS/390 Solution. It also describes the customization needed for OS/390 and DB2 V6.1 and the Lawson installation process to install the applications. It includes guidelines for setting up and administering DB2 for Lawson Insight.

This redbook will be especially useful for those installing Lawson Insight Applications on OS/390 for the first time.

The team that wrote this redbook

This redbook was produced by a team of specialists from around the world working at the International Technical Support Organization Poughkeepsie Center.

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Chapter 1. Overview

This redbook describes the installation experiences of the Lawson Insight Applications using S/390 (DB2 for S/390) as the data server.

1.1 Lawson Software application overview

Lawson Software provides Web-deployable, enterprise-wide, client/server business applications for companies in the mid- to high-end markets.

The Lawson Insight II Business Management System is comprised of six process suites. These suites support and facilitate the cross-functional execution of business processes:

- Human Resources
- Financials
- Procurement
- Supply Chain
- Collaborative Commerce
- Enterprise Budgeting

Lawson's products have evolved with client/server technology. A multi-tiered client/server architecture enables customers to place the three main components of the Lawson system – application logic, data management and presentation management – where they will be most effective in addressing business problems. While many of Lawson's first-generation client/server competitors utilize two-tiered structures, Lawson's second-generation client/server model is highly scalable and optimized for high-volume on-line transactional processing environments.

Lawson's open-platform, open-database, object-oriented technology is incorporated into the Lawson Insight II Business Management System, a line of fully integrated process suites that can operate across disparate systems in heterogeneous environments, that consist of the following:

- Lawson Insight II Analytic Suite

  The Lawson Insight II Analytic Suite is tightly integrated into an Enterprise Analytic Warehouse which gives key decision makers extraordinary visibility to the business and financial processes. The Lawson Insight II Analytic Suite is comprised of three modules: Performance Indicators, Analytic WorkBench, and Analytic Architect.

- Self-Evident Applications

  Self-Evident Applications (SEA) is Lawson Software's strategy for the next generation of enterprise application software. The SEA model is based on a network-centric architecture designed to deliver application functionality to light-client, browser-based desktops. Self-Evident Applications uses the light-client, browser, and point-and-click technologies introduced by the Internet and World Wide Web to revolutionize the applications software landscape.

  Conventional client/server applications are forms-driven or transaction-driven, versus self-evident applications, which are information-based. The conventional client/server model requires re-engineering of business

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processes, versus natural optimization of business processes. Lawson's SEA model accomplishes natural optimization through automatic, dynamic and personalized web pages that yield self-evident actions. Immediate benefits of this technology are the elimination of expensive and time-consuming application software training requirements (which Lawson calls Zero Training) and the mass deployment of graphical enterprise applications systems via corporate intranets and extranets.

- Open Component Solutions

  Lawson Insight II Open Component Solutions allow users to access, view, and interact with enterprise information using the technology of their choice. Desktops, forms, charts, and graphs can be viewed and tailored using Lawson Insight II Open Component Solutions with Open Component Desktops and Open Component Tools for: Java, Active-X, Lotus Domino, Javascript/HTML.

Lawson Software provides global and industry-specific solutions. Following is a list of their business process solutions and industry solutions.

- Business Process Solutions (Integrated e-business Solution)

  Collaborative Commerce Suite B
  Enterprise Budgeting
  Financials Suite
  Human Resources Suite
  Procurement Suite
  Supply Chain Suite
  Relationship Management Suite

- Industry Solutions

  Healthcare
  Retail
  Professional Services
  Public Sector
  Wholesale Distribution
  Financial Services

1.2 Lawson system architecture

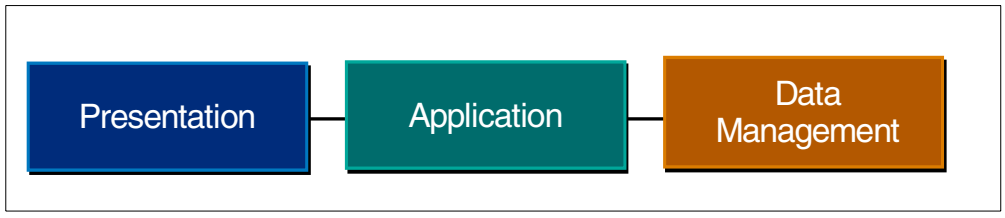

Figure 1. Lawson three-tier logical architecture

Lawson Insight is implemented via a three-tier client/server (logical) architecture: a presentation layer, an application layer, and a database layer, which can be implemented on one to n hardware platforms.

Today the presentation layer (client) is referred to as the Lawson Insight Desktop (LID) and is a set of Windows-based desktop applications (Process Menus,

Agents, Desktop Tabs, and so forth). In the future, they will use their Open Component Solution.

The application layer (application environment) is either Lawson Insight NT Environment (LINTE) or Lawson Insight UNIX Environment (LIUE), depending on which environment was chosen.This layer provides the infrastructure (printing and so forth), as well as the applications.

The data management layer (the database server) provides for data access, including access to the Relational Data Base Management System (RDBMS), This is referred to as the Multi Database System (MDBS).

Note: If the Lawson Web products are used, then there is the potential need for additional servers for the Web products and the Web Server itself. We did not implement any of the Web functions/servers.

TCP/IP is the communication protocol used to connect the layers (servers), and DB2Connect handles the database communication between the application server and DB2 via DDF (Distributed Data Function) on S/390.

1.3 Lawson application layer architecture

The application *environment* (LINTE or LIUE) provides the system functionality for the application instances.

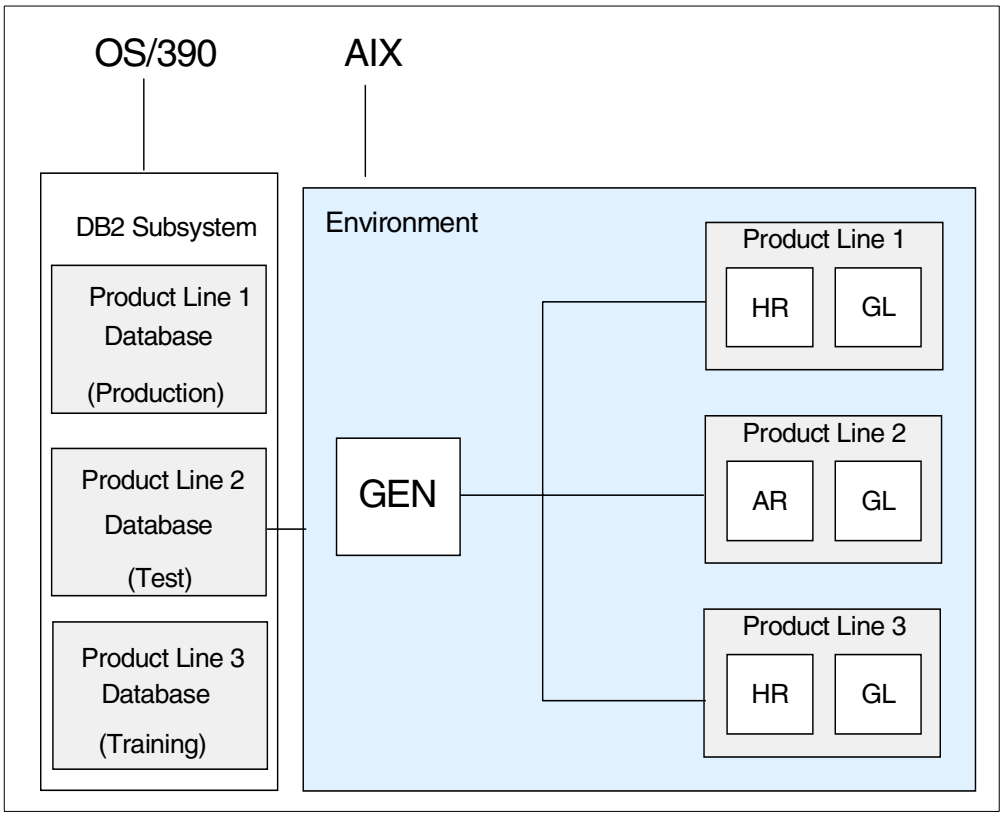

Figure 2. Lawson application system

Multiple instances of Lawson Insight applications can exist in one environment. These instances are referred to as *product lines*; typical use of multiple product lines would be to provide for separate development, test, and production systems.

Note: The term *system* has a different meaning when used by Lawson, as described in the following quotation. The use of the term system throughout the remainder of this book is *not* as used by Lawson:

> "The product line, then, is a set of applications, such as General Ledger, Accounts Payable and so forth. Individually, each application is referred to as a *system,* such as the GL (General Ledger) system. Each product line contains its application source code, objects, data and data dictionary. All product lines, within an environment, share utilities and GEN data (which holds environmental level information). It is also possible to have multiple environments in a single server, in this case they would be isolated, that is, they do not share anything (tools, GEN data). Multiple environments would be useful when migrating from one release of Lawson Insight to another."

1.4 Database layer

When S/390 is used as the data server, DB2 for OS/390 is the only database supported. DB2Connect is used for communication between the application server and DB2 Distributed Data Facility (DDF).

Note: Lawson Insight maintains a data dictionary in the application layer. Any changes made outside Lawson's control must be also made to the Lawson environment. Otherwise, the system will be out of synchronization. For example, if you add a tablespace to DB2 on OS/390 using a DB2 command, you must also make this change to the Lawson data dictionary on the UNIX or NT platform.

The application layer uses simple SQL. Joins, referential integrity, and so forth are done by the application and not by DB2.

The typical DB2 installation should only encounter two noteworthy differences when implementing Lawson with DB2. These differences are:

- The number of tables (Lawson applications uses a much larger number of tables than are typical at most non-ERP installations)
- The table data needs to be stored in ASCII (which is implemented by a DB2 parameter).

1.5 Presentation layer

The presentation layer (client) is implemented on Microsoft's Windows, either NT or 9x. The connection to the application layer via TCP/IP is essentially a telnet session with a GUI front end.

Web clients are not covered in this document.

1.6 Security

User security is provided by Lawson Insight in the application server, and different levels of security can be assigned by function. There are exposures in

the security scheme, in that users are essentially “telneted in” to the application server and it is possible for a user to get to the command prompt of the UNIX system.

DB2 on the S/390 is accessed only by DB2Connect. Users do not log into the S/390. Standard OS/390 Security Server (RACF) protection is used to protect DB2.

1.7 Printing

Printing is a function of the application layer, that is, of AIX.

Installations often want to leverage their existing S/390 printing infrastructure and in Lawson's case, this would be the done the same way as with any other AIX-to-S/390 printing situation, that is, with the OS/390 Print Server, which provides an infrastructure for this kind of cross-platform printing.

1.8 Batch

Batch work for Lawson Insight is a function of the application server. Lawson's application server provides for both scheduling of work and a priority management scheme. This priority management is implemented through the use of the UNIX `nice` command, and there is no communication with OS/390's Workload Manager.

1.9 OS/390 features for Lawson Applications

OS/390 is an integrated enterprise server operating system environment. It incorporates into one product an open communication server, distributed data and file services, Parallel Sysplex support, object-oriented programming, and open application interfaces.

OS/390 continues to build on the classic strengths of MVS-reliability, continuous availability, serviceability, data integrity, workload management, and security. OS/390 gives you a scalable system that supports massive transaction volumes and large numbers of users with high performance, as well as advanced system and network management.

Lawson user data is stored on its database server. On S/390, Lawson uses DB2 as the database server, which can manage large amounts of data on behalf of many users.

The strengths that OS/390 and System/390 bring to the Lawson environment include:

- Reliability, availability, and serviceability

  Lawson S/390 customers need continuous data availability and integrity. OS/390 reliability and availability is unsurpassed and it has a history of unmatched security and integrity. Lawson benefits from these underlying characteristics.

- Scalability

The System/390 platform ranges from small uniprocessors to 12-way processors to Parallel Sysplex environments which allow you to connect up to 32 OS/390 systems. The architecture of the System/390 I/O subsystem and the OS/390 operating system allow data to be transferred into memory from many devices simultaneously, allowing the processing of data requests for many users at high data rates.

The requests may require accessing data residing in multiple-terabyte repositories.

- System management

  OS/390 has many system management capabilities, providing data security, strong operations tools, and the ability to manage diverse workloads. System/390 has proven procedures and tools to manage systems in a very efficient way.

- Cost of ownership

  System/390 is acknowledged by consultants such as IDC, GartnerGroup, Xephon, ITG, and others as having one of the lowest overall costs of ownership in a client/server environment when calculated over multiple years. CMOS technology and software pricing actions have drastically reduced the cost of System/390 enterprise computing.

1.10 DB2 features

DB2 is engineered to deliver the high performance and high levels of availability, integrity, and security needed for your business applications. The strengths DB2 brings to the Lawson Applications environment include:

- Continuous operation and high availability

  DB2 can operate for long periods without interruption. With data sharing, work can be transferred between DB2 subsystems within a Parallel Sysplex as a result of a planned or unplanned outage.

Online reorganization provides greater availability during database unload and reload processes.

- High data integrity

  DB2 provides high data integrity through capabilities such as a sophisticated lock manager and integration with IBM system security products. DB2 also protects data from subsystem, media, and application failures with integrated recovery schemes.

- Very large database support

  DB2 works with the System/390 I/O subsystem to allow the rapid parallel processes needed for very large database backup, reorganization, and recovery of data.

- Database and system administration aids

  To help database administrators manage their database environments, DB2 offers an integrated set of tools and functions, including flexible security mechanisms, an extensive set of logging and recovery utilities, trace facilities for tuning, and functions and tools to monitor and tune subsystems.

- Other features

In addition to the preceding items, the following features have been added to DB2:

- Data compression
- Dynamic Statement Cache
- ASCII tables
- Isolation level read stability
- Keep exclusive locks
- Improvements in DDL concurrency
- SQL RENAME of tables
- SQL STRIP Function

These features are particularly beneficial for an enterprise using Lawson Applications for OS/390.

1.11 Strengths of Enterprise Storage System (ESS) for Lawson

The ESS provides a high availability, scalable, easy-to-manage storage subsystem that complements the strengths of S/390.

The logical disk architecture of the ESS spreads all data across all the available disks, reducing the requirement for data placement to avoid hot-spots. Additional physical storage capacity can be added non-disruptively.

The ESS's architecture also enables FlashCopy. FlashCopy is an data duplicator that allows you to make instant copies of data at the data set and volume level. FlashCopy will be integrated in the DB2 utilities using the concurrent copy interface. This can significantly increase application availability when making point-in-time copies.

For more information, see Appendix J, "Enterprise Storage Server (ESS)" on page 111.

Chapter 2. Overview of our test systems

This chapter provides details about the systems we used and the steps we followed during our tests.

Our middle-tier system was an RS/6000 with AIX. The database server was an OS/390 system with DB2 as shown in Figure 3.

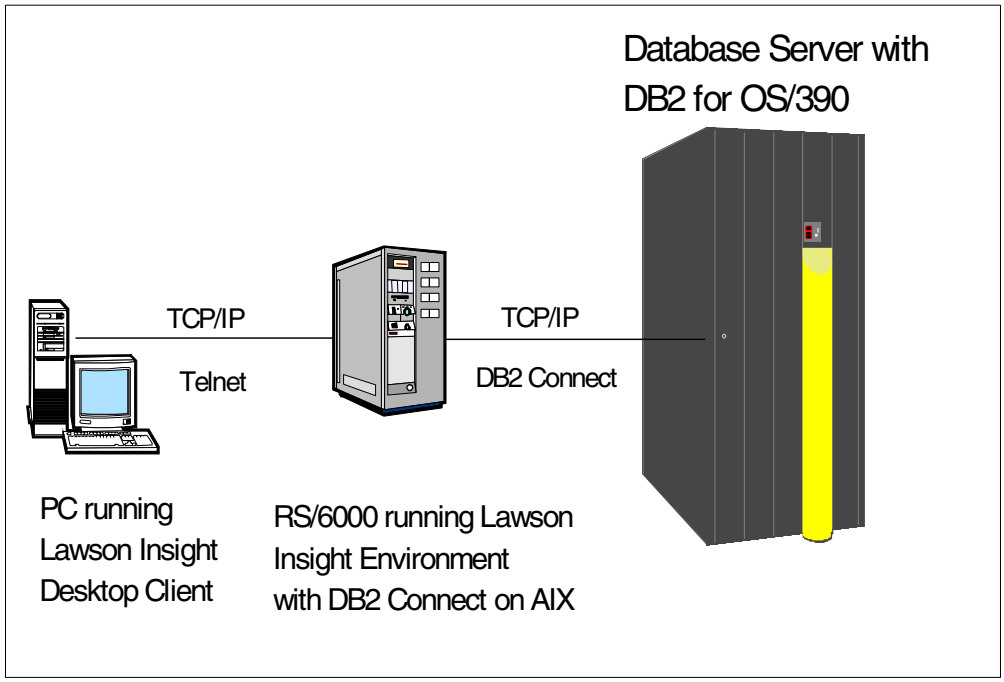

Figure 3. Systems used in the installation process

2.1 Application server system

The system we used as the application server consisted of the following:

- AIX 4.3.2
- DB2 Connect 6.1 with the recommended FixPak
- Lawson Environment Software Release 7.3.1
  Lawson Business Management System 7.2.2
- A 5 GB disk for the Lawson software

2.2 Database server system

The system we used to for the database consisted of the following:

- OS/390 V2R8 with TCP/IP (OS/390 eNetwork Communication Server TCP/IP V2R8)
- DB2 UDB for OS/390 V6.1
- 6 GB of DASD for the database

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2.3 Lawson Client system

The system we used for the client workstation consisted of the following:

- Windows NT 4.0 with Servicepack 3
- Lawson Insight Desktop 7.2.1

2.4 Our installation steps

We used the following Lawson documentation during the installation process:

Lawson Insight II - Installation and Upgrade Manual Version 7.3.1, December 1999, Document Number EIUM-731U

Lawson Insight II - Enterprise Server Version 7.3.1, November 1999, Document Number EES-731U

Lawson Insight II - Database Administration Version 7.3.1, November 1999, Document Number EDA-731U

The steps were:

1. Set up the AIX system with:
   - AIX 4.3
   - C compiler
2. Install the Lawson application software on AIX.

   This step includes installing Microfocus COBOL on AIX.
3. Create a database and tablespace on DB2 on OS/390.
4. Install DB2 Connect V6.1 and the recommended maintenance. (For us this was interim FixPak 1B, which brought us to DB2Connect V6.1.3.)
5. Set up DB2 and Distributed Data Function (DDF) on S/390.

   At this point we tested the connection between DDF and DB2 Connect.
6. Install the Lawson client (LID) software on the PC.
7. Run the Lawson programs to build the dictionary for DB2 and load the tables to DB2.
8. Execute RUNSTATS on the tablespace on DB2.
9. Connect to the Lawson application using the Lawson client logon.
10. Verify that the DB2 database is the same as the Lawson database on AIX.

These steps are described in detail in Chapter 4, “Installation procedure” on page 19.

2.5 Other installation considerations

Before you start, you may want to review the Chapter 8, “Problems we encountered” on page 65, to avoid making the same errors we did.

2.5.1 Lawson directory structure on AIX

There are several directories that make up the Lawson environment on AIX. They are:

$**GENDIR (/gen**) This is used to store the environment utilities and the original copies of the files.

$**LAWDIR (/dir**) This is used to store business applications and server configuration files.

$**LADBDIR (/DB)** This is used to store data dictionaries and environment data.

$**TMPDIR (/tmp)** This is used to store Lawson temporary files.

In our case we used the mounted file system /erp for our Lawson software so our directory structure was as shown in Figure 4:

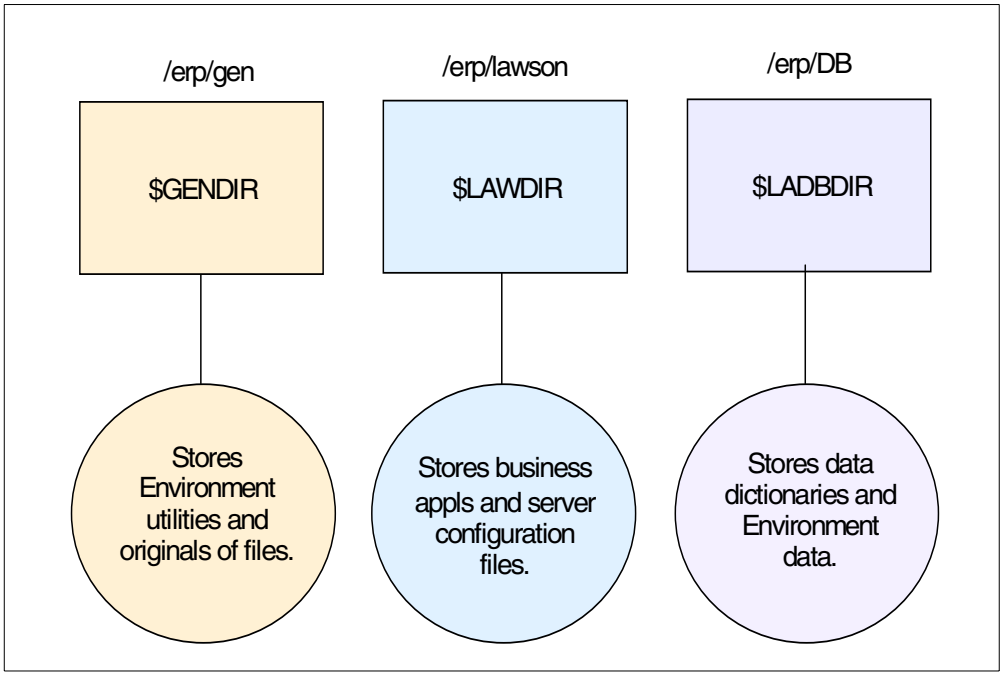

Figure 4. Lawson directory structure

2.5.2 Using variables

Ensure that you make consistent use of the unique values for the variables. If names are mismatched, it will cause execution problems. The following tables list the variables that are required, their definition, and the values we used.

2.5.2.1 Values for profile

Table 1 lists the variables required for the profiles of user IDs root and lawson.

Table 1. Variables required for profiles

Variable	Definition	Our value
LAWDIR	Directory for Lawson environment	/erp/lawson
GENDIR	Directory for Lawson applications	/erp/gen

Variable	Definition	Our value
LADBDIR	Directory for Lawson database	/erp/DB
TMPDIR	Directory for Lawson temporary files	/erp/tmp
COBDIR	Directory for COBOL	/erp/opt/cobol/cobdir
LIBPATH	Add $COBDIR/lib to LIBPATH	
PATH	Add $COBDIR to PATH	
DB2INSTANCE	Instance name of DB2 on AIX for DB2 Connect	db2inst1

2.5.2.2 Values for file /erp/lawson/test/IBM

These variables are used by Lawson software to connect to DB2.These are stored in the file $LAWDIR/(product line)/IBM, in our case $LAWDIR/test/IBM. These values are used with DB2 Connect to establish connection to DB2 on OS/390. They must be in sync with the values in Table 3.

Table 2. Values for Lawson IBM DB2 file

Variable	Definition	Our value
LAWGATENAME	Lawson DB2 driver name	ibmdb
DBNAME	DB2 Connect alias name	HRTEST1
DB2INSTANCE	DB2 instance on AIX	db2inst1
DB390NAME	DB2 database name for product line TEST	HRTEST1
LOGINNAME	RACF user ID	LAWSON1
PASSWORD	RACF password for user ID lawson	L1xxxx

You need to have one OS/390 TSO user ID for each DB2 database you create, because Lawson uses this as the DB2 creator ID. So for every product line you want to install, you will need to have an associated TSO user ID. We used LAWSON1 for HRTEST1 and later on we used LAWSON2 for HRTEST2.

2.5.2.3 DB2 Connect names

These variables are used when you execute the catalog statements in DB2 Connect. You need to create catalog entries for each database (product line) you want to install.

For HRTEST1 and HRTEST2, these are the four DB2 Connect statements we used in conjunction with the values in Table 3:

```
catalog tcpip node rs6000a remote wtsc48 server serverlawson
catalog dcs database HRTEST1 as DB2B
catalog database HRTEST1 as HRTEST1 at node rs6000a authentication DCS
connect to HRTEST1 user LAWSON1 using L1xxxx

catalog tcpip node rs6000a remote wtsc48 server serverlawson
catalog dcs database HRTEST2 as DB2B
catalog database HRTEST2 as HRTEST2 at node rs6000a authentication DCS
connect to HRTEST2 user LAWSON2 using L1xxxx
```

When you have connected successfully to the database you receive the following message:

```
Database Connection Information

 Database server        = DB2 OS/390 6.1.0
 SQL authorization ID   = LAWSON1
 Local database alias   = HRTEST1
```

Note: We later found that to load the training data successfully we had to enlarge the HEAP parameter. This is done as a db2 command line entry. If you are already connected to DB2 as we were at this point you can issue the command:

```
db2 => update dbm cfg using  DRDA_HEAP_SZ 4096
```

or at the prompt, you can issue the command:

```
$ db2 update dbm cfg using  DRDA_HEAP_SZ 4096
```

Table 3. Values for DB2 Connect for HRTEST1

Variable	Definition	Value
node	Host name of RS/6000 system	rs6000a
remote host	Host name of S/390 system	wtsc48
DB2	DB2 OS/390 subsystem name - DDF Location parameter	DB2B
Database alias	DB2 alias name for DB2 Connect	HRTEST1
serverlawson	DDF Port number listed in /etc/services	33326

2.5.2.4 User IDs

These are the S/390 TSO RACF user IDs.

Table 4. User ID for OS/390

User ID	Definition	Password
LAWSON1	TSO RACF user ID for TEST product line	L1xxxx
LAWSON2	TSO RACF user ID for TRAINING product line	L2xxxx

2.5.2.5 AIX user IDs

If you install the DB2 instance on AIX, several db2 user IDs are created for you (the number of user IDs depends on the products you select). These user IDs are set up with a profile that allows them to execute the db2 command so you can configure DB2 Connect.

You must add the following line to the LAWSON1 user ID profile so it can access DB2Connect as well:

. /home/db2inst1/sqllib/db2profile

Table 5. User IDs for AIX

User ID	Definition
lawson	Created by envsetup
lawson1	Created by envsetup
Ulawson	Created by envsetup
db2inst1	Created by db2 connect
db2fenc1	Created by db2 connect

2.5.2.6 Lawson Data definition variables

Table 6. Values for Lawson Data definitions

Variable	Definition	Our value
Product Line	Name of product line installed.	TEST
DBSPACENAME	DB2 database name for product line.	HRTEST1
Type	Use the Select key to choose the database type. IBM is for DB2.	IBM
Segment name	This is the DB2 on OS/390 tablespace name to store the product line.	BIGSPACE
Index segment name	This is the DB2 Stogroup name that should be used for the create index statements that Lawson generates.	LAWSONGP

2.6 Setting up multiple Lawson Environments

Creating multiple Environments provides a flexible alternative for clients who need scalable test and production environments. For example, application updates and administrative changes to the Lawson file manager can be performed in one Environment without impacting the other on the same machine. Each Environment consists of a complete installation of Environment and the Lawson Business Applications, and must reside in unique pathnames and/or file systems.

The key requirement for running multiple Environments on the same machine is for each Environment to have unique values assigned to the LAWDIR, GENDIR, LADBDIR, and LAWIPC UNIX environment variables. These variables are required for the proper operation of the Lawson Insight Applications. Clients who are currently running only one Environment may not be familiar with the LAWIPC variable and are probably unaware that LAWIPC is set to 0x70 hex for Environment 7.x.

LAWIPC plays a vital role in uniquely identifying the Lawson file server manager (ladb), transaction processor (latm/oltp), job scheduler (lajs), and compile queue (queue) interprocess communication entries. Note that the Lawson interprocess entries are represented in hex as opposed to decimal, and can be viewed using

the `ipcs` command. The value of LAWIPC is important when there is more than one Environment installed on a single machine.

To switch between one Insight 7.x Environment and another, users need access to a UNIX prompt.

If you do not allow end users access to the UNIX prompt, you will need to create a second UNIX login for them, which accesses the new 7.x environment.

For more information on how to set up multiple environments, contact the Lawson specialists in IBM Global Service or Lawson support.

Chapter 3. Preparing DB2

We recommend that you do the following when you create the Lawson DB2 subsystem:

- Provide a standalone DB2 subsystem for the Lawson data.
- Store the data in ASCII, not EBCDIC.

  This can be done at the subsystem level by adding DSNZPARM ENSCHEME=ASCII. If there is a need to have a mixture of database types in the same subsystem, you can add the parameter CCSID ASCII to the create database command.
- Create the tablespace definitions with the following parameters in the create tablespace command:

  SEGSIZE 32 and LOCKSIZE ROW
- Ensure the EDM pool size is large enough to handle the Lawson DBDs. We used the value of 100 Mb.
- Use of dynamic SQL caching improves performance, so we added the parameter DSNZPARM CACHEDYN=YES.

For more information, refer to Chapter 11 in Lawson document *Enterprise Server Version 7.3.1,* Number EES-731U.

3.1 Setting up DSNZPARMS

The DSNZPARMS we used are listed in Appendix E, “DSNZPARMS for DB2” on page 89.

3.2 Setting DDF

DDF must be running in order for DB2 Connect to be able to establish a connection to the DB2 subsystem running on OS/390. On our system, DDF listened on TCP/IP port 33326.

Appendix D, “Setting up DDF” on page 85, describes the steps we executed to set up DDF on our subsystem. If you have trouble connecting, make sure DDF is running. In our case, several times we had to stop and start DDF to establish the connection.

3.3 Adding more temporary tablespaces

The first time we tried to load the database (using the reorganization function of the Lawson Database Maintenance utility), we ran into a problem of unavailable resources. We determined we did not have enough temp tables for DB2 using only the two default tables. We ran a job to create two more temp tables and then the load completed successfully. Before you start, you may want to review how many temp tables you have and increase the number, if necessary.

The job we used to do this is shown in Appendix F, “Job to add temporary tablespaces” on page 95. We modified the sample job that was in DB2V610B.NEW.SDSNSAMP($TIJUZ).

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3.4 Allocating stogroups, database, and tablespaces on DB2

These are the DDL statements we used to create the stogroup, database, and tablespace for our installation of the *test* product line.

```
CREATE STOGROUP LAWSONGP VOLUMES ('TOTLA2') VCAT DB2BLAW;

CREATE DATABASE HRTEST1 BUFFERPOOL BP1 STOGROUP LAWSONGP;

CREATE TABLESPACE BIGSPACE  IN HRTEST1
SEGSIZE 32 BUFFERPOOL BP1 LOCKSIZE ROW USING STOGROUP LAWSONGP
PRIQTY  100000     SECQTY     100000;

COMMIT;
```

Note: The VCAT entry of DB2LAW becomes the high level qualifier for the VSAM files. You may want to make this an alias entry; otherwise, all the many index VSAM files will be cataloged in the master catalogue.

3.5 Activating bufferpools

Using the ISPF DB2 Command line option, verify which bufferpools are active by using the command:

```
DIS BUFFERPOOL (ACTIVE)
```

If you are using a bufferpool that is not active (in our case BP1), issue the following command to activate the bufferpool:

```
ALTER BUFFERPOOL (BP1) VPSIZE (1000)
```

3.6 Granting dbadm authority

The TSO RACF user ID that is used by DB2 Connect (in our case, LAWSON1) requires dbadm authority on the database and stogroup so the tables can be created. We issued the command:

```
GRANT DBADM ON DATABASE HRTEST1 TO LAWSON1;
```

3.7 Designing the tablespace layout for an Lawson HR system

After our installation of the Lawson INSIGHT II Human Resources application there were 745 tables and 2185 indexes on our DB2 subsystem for the product line TEST. We put these not only all in one database as required, but also all in one tablespace. We used the same stogroup for the tablespace and the indexes.

A better layout would be to create at least two stogroups and at least 7 or 8 tablespaces. We analyzed several approaches to designing the tablespace layout for the HR application and in our second installation we used a more complicated layout. It is described in 6.1, “Allocating more tablespaces” on page 47.

Chapter 4. Installation procedure

We used the following Lawson documentation during the installation process:

Lawson Insight II - Installation and Upgrade Manual Version 7.3.1, December 1999**,** Document Number EIUM-731U

Lawson Insight II - Enterprise Server Version 7.3.1, November 1999, Document Number EES-731U

Lawson Insight II - Database Administration Version 7.3.1, November 1999, Document Number EDA-731U

To perform this installation, do the following:

1. Set up the AIX system with:
   - AIX 4.3
   - C compiler
2. Install the Lawson application software on AIX.

   This includes installing the Microfocus COBOL compiler.
3. Install the Lawson (LID) client software on the PC.
4. On AIX, install DB2 Connect V6.1 and the recommended fixpack.

   This is described in “Setting up the AIX system” on page 19 and Appendix C, “Setting up DB2 Connect” on page 81.
5. On AIX, install the Lawson DB2 database driver.
6. Run the Lawson programs to build the dictionary for DB2 and load the tables to DB2.
7. Execute RUNSTATS on the tablespace on DB2.
8. Connect to the Lawson application using the Lawson Client logon.

The last five steps are described in more detail in Chapter 5, “Moving the database to DB2 on OS/390” on page 29.

4.1 Setting up the AIX system

The steps to set up the AIX system are described in *Lawson Insight II - Installation and Upgrade Manual Version 7.3.1,* December 1999, Document Number EIUM-731U.

You must create a file system (we used /erp) and the directory (/gen) which is $GENDIR for the Lawson software. We used a file system of 5 GB that we mounted as /erp.

The first steps of the installation are run using the root user ID. The envsetup command sets the profile variables for the root user ID and the lawson user ID. This is described in “Setting up the user IDs and profile” on page 23.

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4.1.1 Installing Microfocus COBOL

See Chapter 2 of *Lawson Insight II - Installation and Upgrade Manual Version 7.3.1*, December 1999, Document Number EIUM-731U, for the instructions on how to install the Microfocus COBOL Compiler.

We chose the directory /erp/opt/cobol/cobdir for the installation directory.

The commands are:

- Logon as root.
- `umask 022`
- `cd /erp`
- `mkdir /opt/cobol/cobdir`

  Mount the Microfocus COBOL CD-ROM on the mount point /cdrom.
- `cd /erp/opt/cobol/cobdir`
  Copy the file from the Microsoft COBOL CD-ROM.
- `cp -rp /cdrom/cobol.tar cobol.tar`

  The `tar` command explodes the files to the current directory - in our case $COBDIR.
- `tar xvf cobol.tar`
- `sh ./install`
- Press Enter (for default path).
- Type: `yes` (to install the license manager).
- Type: `yes` (for the default license directory).
- Type: `yes` (to create the license directory).
- Type: `yes` (to automatically start the license manager at boot time).
- `cd lmf`
- ./mflmcmd
- Type: `I` (to install).

Note: The license key is written on the Microfocus COBOL CD-ROM. At this point it was in our CD-ROM drive and we had to cancel out of the mflmcmd process to switch to SMIT in order to unload the CD-ROM. AIX does not allow you to physically remove the CD-ROM without issuing the unmount command. We had to reissue the ./mflmcmd command and at the prompt do the following:

- Enter the serial number from the label on the CD-ROM.
- Enter the license key from the label on the CD-ROM.
- `.sh mflmman` (to the license manager)
- `export COBDIR=/erp/opt/cobol/cobdir`
- `echo $LIBPATH`
- `export LIBPATH=/erp/opt/cobol/cobdir/coblib:$LIBPATH`
- `export COBTERMINFO=/usr/lib/terminfo`
- `cob`

- cobv
- cobrun

The last three commands are used to verify the installation is complete. The reply is:

```
I see no work
```

Check to make sure that the AIX C compiler is installed on your RS/6000 and at the end of the installation add the following variables to the lawson user ID .profile:

```
COBDIR=/erp/opt/cobol/cobdir
LIBPATH=/erp/opt/cobol/cobdir/coblib
export COBDIR
export LIBPATH

If LIBPATH already has some values the command should be:
LIBPATH=/erp/opt/cobol/cobdir/coblib:$LIBPATH
```

4.2 Installing the Lawson Insight environment

These steps are described in detail in Chapter 3 and Chapter 4 of *Lawson Insight II - Installation and Upgrade Manual Version 7.3.1*, December 1999, Document Number EIUM-731U.

4.2.1 Setting up the AIX environment

Logon as user ID root, mount the Lawson environment CD-ROM, and copy the files to your setup directory using the following commands:

- Log on as root (do not use the `su` command to switch to root).
- `umask 0`
- `cd /erp`
- `mkdir gen` (if not already created)
- `export GENDIR=/erp/gen`
- `cd $GENDIR`
  Check that the CD-ROM is mounted on mount point /cdrom.
- `cp /cdrom/aix42/envsetup  $GENDIR/envsetup`

To be able to do the next step, you must have Lawson license information available; it comes with the Lawson software in a white folder. There is a separate sheet for each product. The values you need are CDKEY (a decryption key) and CUSTOMERID (client).

- `./envsetup /cdrom  aix42 {CD KEY} {CUSTOMER ID}`

When the setup process is complete, review the $GENDIR/envsetup.log to check if there were any error messages. Our envsetup.log file listed the following:

```
Wed Jan 26 10:49:43 2000: cp -p /cdrom/aix42/base.prd /erp/gen/base.prd
Wed Jan 26 10:49:58 2000: Decompressing base.tar.Z
Wed Jan 26 10:50:19 2000: Extracting base.tar
Wed Jan 26 10:50:41 2000: Removing base.tar
Wed Jan 26 10:50:41 2000: cp -p /cdrom/aix42/univ.prd /erp/gen/univ.prd
```

```
Wed Jan 26 10:51:02 2000: Decompressing univ.tar.Z
Wed Jan 26 10:51:32 2000: Extracting univ.tar
Wed Jan 26 10:51:58 2000: Removing univ.tar
Wed Jan 26 10:51:58 2000: cp -p /cdrom/aix42/case.e /erp/gen/case.e
Wed Jan 26 10:51:59 2000: Decrypting File case.e
Wed Jan 26 10:52:06 2000: Removing case.e
Wed Jan 26 10:52:06 2000: Decompressing case.tar.Z
Wed Jan 26 10:52:07 2000: Extracting case.tar
Wed Jan 26 10:52:07 2000: Removing case.tar
Wed Jan 26 10:52:07 2000: Decrypting File bin/ladb.e
Wed Jan 26 10:52:10 2000: Removing bin/ladb.e
Wed Jan 26 10:52:10 2000: Decrypting File bin/lajs.e
Wed Jan 26 10:52:15 2000: Removing bin/lajs.e
Wed Jan 26 10:52:15 2000: Decrypting File bin/pgmdef.e
Wed Jan 26 10:52:34 2000: Removing bin/pgmdef.e
Wed Jan 26 10:52:34 2000: Decrypting File bin/lapm.e
Wed Jan 26 10:53:15 2000: Removing bin/lapm.e
Wed Jan 26 10:53:15 2000: Decrypting File bin/cmprts.e
Wed Jan 26 10:53:15 2000: Removing bin/cmprts.e
Wed Jan 26 10:53:15 2000: Creating Perms File
Wed Jan 26 10:53:16 2000: Removing Perms.old
Wed Jan 26 10:53:16 2000: Set Up Is Complete
```

The next step is to unmount the environment CD-ROM and mount the license CD-ROM. Then copy the license file to the $GENDIR/system directory using the command:

```
cp /cdrom/license $GENDIR/system/license
```

Then enter the command:

```
install/install
```

We answered as follows:

- `y` (for UUCP)
- `y` (to add Lawson user)
- `/erp/lawson` (for LAWDIR)
- `/erp/DB` (for LADBDIR)
- `lawenv1` (for environment - this is your choice)
- Enter (if the COBDIR is correct)
- `y` to confirm GENDIR, LAWDIR, LADBDIR and COBDIR
- `y` (to create directory lawson)
- `y` (to create directory DB)
- `y` (to Ulawson user ID)
- `y` (to add lawson group)

It now installs, which takes a few minutes.

- `y` (for production environment), or `no` (if not production)

Installation is now complete.

If you want to review the log, go to the install directory and issue the `ls` command. The name of the log file is L.xxxxxxxxxxxxxxxx (series of numbers). Our log file was called $GENDIR/install/L.000129122358.

- Unmount the license CD-ROM.

4.2.1.1 Setting up the user IDs and profile

This step created the following user IDs:

User ID	UID	Home directory
lawson	80	/erp/gen/lawson
lawson1	90	/er/gen/lawson
Ulawson	81	/usr/spool/uucpublic

The envsetup command adds the following lines to the $LAWDIR/lawson.env file which gets executed as part of the lawson profile for the lawson user ID.

```
GENDIR=/erp/gen
LAWDIR=/erp/lawson
LADBDIR=/erp/DB
TMPDIR=/erp/tmpdir
export GENDIR
export LAWDIR
export LADBDIR
export TMPDIR
```

The COBOL compiler requires the following variables, which are added by the envsetup command:

```
COBDIR=/erp/opt/cobol/cobdir
LIBPATH=/erp/opt/cobol/cobdir/coblib
export COBDIR
export LIBPATH
```

This is the .profile in /erp/gen/lawson that was created by the envsetup command:

```
vi .profile
# Generated by Lawson Environment install
. /erp/lawson/system/profile
~
~
. /erp/lawson/lawson.env
umask 000

Term=`$GENDIR/bin/termtype -`
if [ "$Term" = dumb ]
then
        if [ "$TERM" = "" ]
        then
                if [ `$GENDIR/bin/path tset` != "" ]
                then
                        TERM=`tset - -m :\? -Q`
                        export TERM
                else
```

```
                        echo "What is your terminal type? \c"
                        read TERM
                        export TERM
                fi
        fi
else
        if [ "$TERM" != univwin ]
        then
                TERM=$Term
                export TERM
"profile" 26 lines, 376 characters
Profile generated in /erp/lawson/system

OPT is the directory for the Cobol installation

# Generated by Lawson Environment install Wed Jan 26 11:08:16 EST 2000
GENDIR=/erp/gen
LAWDIR=/erp/lawson
LADBDIR=/erp/DB
COBDIR=/erp/opt/cobol/cobdir
if [ "$LIBPATH" = "" ]
then
        LIBPATH=/usr/lib:$COBDIR/coblib
else
        LIBPATH=$LIBPATH:$COBDIR/coblib
fi
PATH=$GENDIR/bin:$COBDIR/bin:$PATH:/usr/ccs/bin
export PATH GENDIR LAWDIR LADBDIR COBDIR LIBPATH
```

With this profile, which is executed when you logon to user ID lawson, all variables are set correctly so you can access Lawson applications and the COBOL compiler.

4.2.2 Executing the application setup

This step is described in Chapter 7 of *Lawson Insight II - Installation and Upgrade Manual Version 7.3.1*, December 1999, Document Number EIUM-731U.

Logon to the user ID lawson by issuing the command:

`su - lawson` (to execute the new profile).

Mount the Lawson Insight II Business Management System CD-ROM and copy the applications from the CD-ROM directory to the applications by using the command:

```
appsetup /cdrom 72 test <decryption key > <clientid>
```

The release number of the Lawson software is 72, our product name is test, and the decryption key and clientid are the keys you receive on the license information pages from Lawson. The appsetup command unloads the files from the CD-ROM, so it takes a while to execute.

To load the system data into the Lawson environment on AIX, enter the command:

```
appinstall test
```

After some time, this process asks several questions to which we replied:

- `y` (to load the data for wfagent.dmp)
- `y` (to load the data for wfagntproc.dmp)
- `y` (to load the data for wfform.dmp)
- `y` (to load the data for wformfields.dmp)
- `y` (to load the data for wfobject.dmp)
- `y` (to load the data for wfqueues.dmp)
- `y` (to load the data for wfroleque.dmp)
- `y` (to load the data for wfroles.dmp)
- `y` (to load the data for wfservice.dmp)
- `y` (to load the data for wfsrvagnts.dmp)
- `y` (to load the data for wfusrprofl.dmp)
- `y` (to load the data for wfusrrole.dmp)
- `y` (to load the data for wfworkcat.dmp)
- `y` (to load the data for padict.dmp)
- `y` (to load the data for padict2.dmp)
- `y` (to load the data for pwtopic.dmp)
- `y` (to load the data for prstate.dmp)
- `y` (to load the data for prtaxlevy.dmp)
- `y` (to load the data for prtaxcat.dmp)
- `y` (to load the data for prgarntype.dmp)
- `y` (to load the data for bncategory.dmp)
- `N` (to UK language definitions as American is the default)
- `Y` (to the question, is this a production environment)

After a few minutes you receive a message that the installation is now complete.

The file $LAWDIR/test/Admin/CDROM.inst contains information about the installation. These are the first few lines of the CDROM.inst file (which is 10739 lines, 372765 characters in size).

```
Loading ug.exp definitions
From Product Line DELIV722
To   Product Line TEST
File ACACCTCAT  Being Added
File ACACCTCATX Being Added
File ACACTGRP   Being Added
File ACACTIVITY Being Added
File ACACTMXVAL Being Added
File ACACTREL   Being Added
File ACACTSEG   Being Added
File ACADDASSGN Being Added
File ACADDRESS  Being Added
File ACAMCODE   Being Added
File ACASSIGN   Being Added
File ACAUDIT    Being Added
```

```
File ACBILL     Being Added
```

Note: There are more lines in this file which are not shown here.

4.2.3 Compiling the applications

To compile the applications, enter the following command:

```
nohup cobcmp test > test.cmp 2>&1 &
```

The last ampersand (&) indicates that these compiles should run as a background process. You can monitor the status of the compiles by using the `qstatus |more` command.

We left off the last & to check that the compile was, in fact, running. If the `nohup` command comes back immediately, check the test.cmp file to see if there are any error messages.

In our case, there were 947 jobs to compile. The `qstatus |more` command shows the jobs left to execute. It executes the first job, and then the second job up to 947. Check the top of the qstatus file, not the end of the file.

At the end of the compiles you should check for any error messages. The only file we had with an error message was in /erp/lawson/test/hrsrc/HRS1.err. You can search for .err files or look in each of the xxxrc directories in the $LAWDIR/product line directory.

Our error file contained the following:

```
Compiled on rs6000a

scrgen -s TEST HR HRS1

Building /erp/lawson/test/sdlib/HRS1SD
Building COBOL Shell

Processing PgmInfo Request ...
bismark TEST HR HRS1
Syntax Check   /erp/lawson/test/hrsrc/HRS1WS
Syntax Check   /erp/lawson/test/hrsrc/HRS1PD
Syntax Check   /erp/lawson/test/pdlib/HRSI71PD
Syntax Check   /erp/lawson/test/pdlib/PAPCTPD
Syntax Check   /erp/lawson/test/pdlib/HRFN70CP
Syntax Check   /erp/lawson/test/pdlib/HREMPGRP70
Syntax Check   /erp/lawson/test/pdlib/HRLO70CP
Syntax Check   /erp/lawson/test/pdlib/IFOBI70CP
Syntax Check   /erp/lawson/test/pdlib/HRHEUPD
Syntax Check   /erp/lawson/test/pdlib/PAPCTIOPD
Syntax Check   /erp/lawson/test/pdlib/HREMPVAL
Syntax Check   /erp/lawson/test/pdlib/HRJBCVAL
Syntax Check   /erp/lawson/test/pdlib/BNAT70CP
```

Note: There are more lines in this file which are not shown here.

```
File GEN/SCREEN Index SCNSET1.
```

```
StoreDBRec error is Duplicate record (9).
 ProductLine    = TEST
 SystemCode     = HR
 ProgramCode    = HGLS
 ScrNbr         = 049

Error - scrgen Failed for TEST HR HGLS - Unable To Continue
/erp/gen/bin/bismark: Error Encountered In Execution
/erp/gen/bin/lawosh: Error Encountered In Execution
(EOF):
```

Note: The compiles take about four hours. In one installation, we thought we were done in several minutes. There was no indication of a problem, but when we issued the qstatus command, we saw that the compile jobs were still in the queue. We determined we had a permissions problem with /tmp for the lawson user ID; in another case, the COBOL license daemon was not running.

4.3 Installing the Desktop Client

To install the Desktop Client, you need the Lawson Insight II Desktop Client Version 7.3.1 CD-ROM and the customer number and CD key.

The steps to install the Lawson Client are:

1. Run setup from the CD-ROM on the PC workstation.
2. Enter the customer number and the CD Key.
3. Click **Next**.
4. Click **Next** again.
5. Choose **typical** and click **Next**.
6. Click **Next** to select the default installation directory C:/lawson.
7. Choose **Human Resources help** and click **Next**.
8. Choose **UNIX environment help** and click **Next**.
9. Click **No** to prevent desktop tabs from starting automatically.
10. Choose **winsock compatible** and click **Next**.
11. Click **Next** to use the default program folder.
12. Click **Next** to begin installing.
13. Click yes to add applications to the desktop tabs.
14. Click **Ok** to search for all applications and click **Ok** when search completes.
15. Click **Ok** for end of install.
16. Click **Exit** to complete the installation.
17. Click **Yes** to exit.

Now you can go to **Start-->Programs-->Lawson Insight Desktop-->Desktop Client-->Desktop Client** to start the client application.

4.4 Lawson STARTUP and SHUTDOWN procedures

This section provides Lawson system administrators with the procedures for starting up and shutting down a Lawson system. It assumes the installation of Lawson was complete and the environmental variables were properly set.

Note: Refer to Lawson System Administration documentation for information about starting and stopping Lawson servers. This redbook is not intended to override Lawson guidelines. A Lawson system administration course should be taken before using these procedures.

4.4.1 The SHUTDOWN procedure

The steps to shut down a Lawson system are as follows:

1. Communicate to the Lawson users and business management team the time that the Lawson system will be taken offline (if time permits). Tell the users to log off during this time and notify them when the system will be back on line.
2. Determine how many users are on the system prior to shutting down Lawson. If users are on the system, you should determine which processes are being used, then contact the users to stop the processes (or kill these processes, if they are idle). Use the following method:
   - Run the Lawson DBUSERS command with the -p option, and then with the -n option.
   - Use the Lawson TMMON command to validate that all programs are idle.
   - Use UNIX commands to kill a user Login ID if it is idle.
3. Shut down Lawson. Use the following method:
   - Run the Lawson STOPLAW command (refer to Lawson documentation for information about this command).

Log the Shutdown entry into the Lawson Production Manual with the time and date.

4.4.2 The STARTUP procedure

The steps to start a Lawson system are as follows:

1. Start up Lawson. Use the following method:
   - Run the Lawson STARTLAW command (refer to Lawson documentation for information about this command).
2. Test to ensure the system is up and running. Use the following methods:
   1. Run client login into the Lawson system. Test Inquire, Next, or Previous on records.
   2. Run the UNIX ps -ef command and grep on lawson to view running processes of Database Instances and Lawson Universe environments.
3. Communicate to all users that the system is available and log the Startup entry into the Lawson Production manual.

Chapter 5. Moving the database to DB2 on OS/390

Now that the Lawson environment has been set up on the AIX system, this chapter describes the steps we undertook to move the data to DB2. The steps are:

1. Verify that the DB2 subsystem is ready by ensuring these activities have been completed.
   - Install a DB2 subsystem for Lawson.
   - Set up the DSNZPARMS for Lawson. Make sure the database stores the data in ASCII (not EBCDIC). The DSNZPARMS we used are shown in Appendix E, “DSNZPARMS for DB2” on page 89.
   - Set up DDF with port for DB2 Connect. Our setup is shown in Appendix D, “Setting up DDF” on page 85.
   - Set up user IDs for Lawson and grant dbadm authority.
   - Allocate packs with a large VTOC.
   - Create a database and tablespaces on DB2 for OS/390.

     These steps are described in more detail in Chapter 3, “Preparing DB2” on page 17.
2. Create the Lawson DB2 driver.
3. Configure DB2 Connect.
4. Set up the Lawson DB2 definitions (including the file sizes and database spaces).
5. Build the Lawson dictionary for DB2.
6. Reorganize the database (this loads the data to DB2).
7. Execute the RUNSTATS utility to collect statistics and verify that the Lawson environment matches the DB2 layout using the verifyibm script.
8. Test by logging on the Lawson application.

The process of moving the database to DB2 on OS/390 is described in Chapter 7 of the Lawson manual - *Lawson Insight II - Enterprise Server Version 7.3.1*, November 1999, Document Number EES-731U.

5.1 Verifying DB2 for OS/390 is configured

Chapter 3, “Preparing DB2” on page 17, describes the setup that is required for DB2. At this point, we had a DB2 subsystem (DB2B) running that contained the following:

- A database for the TEST product line - HRTEST1.
- A tablespace for all the tables in the TEST product line - BIGSPACE.
- A stogroup for the tablespace and the indexes - LAWSONGP.
- A RACF user ID that had dbadm authority - LAWSON1.
- Active bufferpools - BP0, BP1 and BP2.

- Additional temporary tables spaces (we ran out of temporary tablespaces in the first load so we executed the job shown in Appendix F, “Job to add temporary tablespaces” on page 95 to add more DB2 temporary tablespaces).
- DDF was running and DB2 Connect from AIX was able to establish a connection to DB2B.

5.2 Creating the Lawson DB2 driver

Lawson provides a group of objects that must be combined with the IBM DB2 libraries to create the Lawson DB2 database driver. We obtained this driver code from the Lawson Web site:

```
http://support.lawson.com
```

We needed a user ID and password to access the file at this site. The instructions were in the folder of license information we received with the software. The release notes that we downloaded from the same site gave us the installation instructions.

After the file was downloaded, we logged on with user ID lawson on AIX and issued the following command to untar and uncompress the files:

```
tar -xvf db2aix.tar
```

This extracts the following files which must then be uncompressed:

bin/bldibmlawdba.Z, 836 bytes, 2 media blocks
bin/cmpibm.Z, 1231 bytes, 3 media blocks
ibm/bldibmddl.o.Z, 1006333 bytes, 1966 media blocks
ibm/bldibmsec.o.Z, 1008465 bytes, 1970 media blocks
ibm/checkibmplan.o.Z, 1012647 bytes, 1978 media blocks
ibm/ibmdb.o.Z, 1005763 bytes, 1965 media blocks
ibm/ibmdu.o.Z, 1004857 bytes, 1963 media blocks
ibm/verifyibm.o.Z, 1006517 bytes, 1966 media blocks

We then issued the uncompress command for each of these files and had the following files in the $GENDIR directory:

ibm/ibmdu.o
ibm/verifyibm.o
ibm/ibmdb.o
ibm/bldibmddl.0
ibm/bldibmsec.o
bin/cmpibm
bin/bldibmlawdba

We then issued the command:

```
cmpibm db2inst1
```

We chose db2inst1 as the name for our DB2 AIX instance.

This created the database driver ibmdb that is referenced in the Lawson database definition parameters in the file /erp/lawson/test/IBM.

5.3 Setting up DB2 Connect

See Appendix C, “Setting up DB2 Connect” on page 81.

If you create a database instance, the following default user IDs are created as part of the DB2 Connect installation process:

User ID	UID	Home directory
db2fenc1	201	/home/db2fenc1
db2inst1	202	/home/db2inst1

These may vary, depending on the products you select. These user IDs can be used to issue the command db2 to set up the connection.

You must add the following statements to the lawson .profile so the user ID lawson can access DB2 connect.

. /home/db2inst1/sqllib/db2profile

Note: There is a space between the period and the slash.

In our case, we then we exited from the Lawson user ID and issued the command `su - lawson` to have the new profile enabled. (The alternative is to just execute the profile.) With this statement in the profile, the Lawson user ID was now able to issue the command `db2` and then connect to DB2 on OS/390.

5.4 Setting up the database definitions

At this point, run the installation process from the Lawson client on the workstation.

Select **Start-->Programs-->Desktop Client**. Then, from the following menu, select **Desktop Client**.

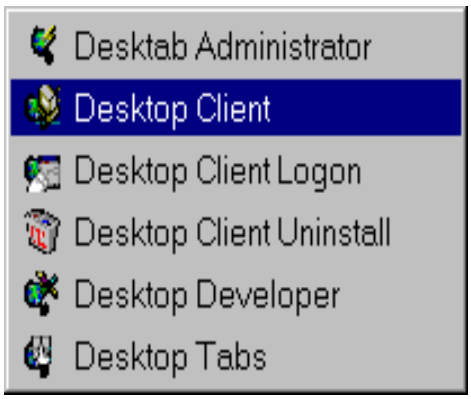

Figure 5. Desktop menu

Click the green phone in the Tool Bar line to set up the connection to the application server. The following window will appear:

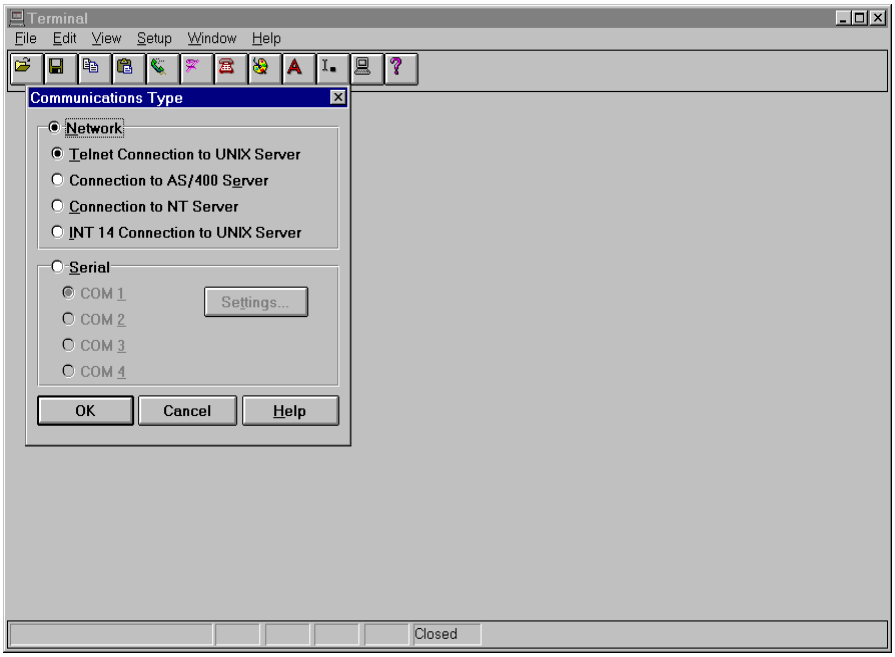

Figure 6. Communication type

Click **OK** on the Communications type window and you will be asked for the host name (or IP address) of the UNIX or NT box that is your application server.

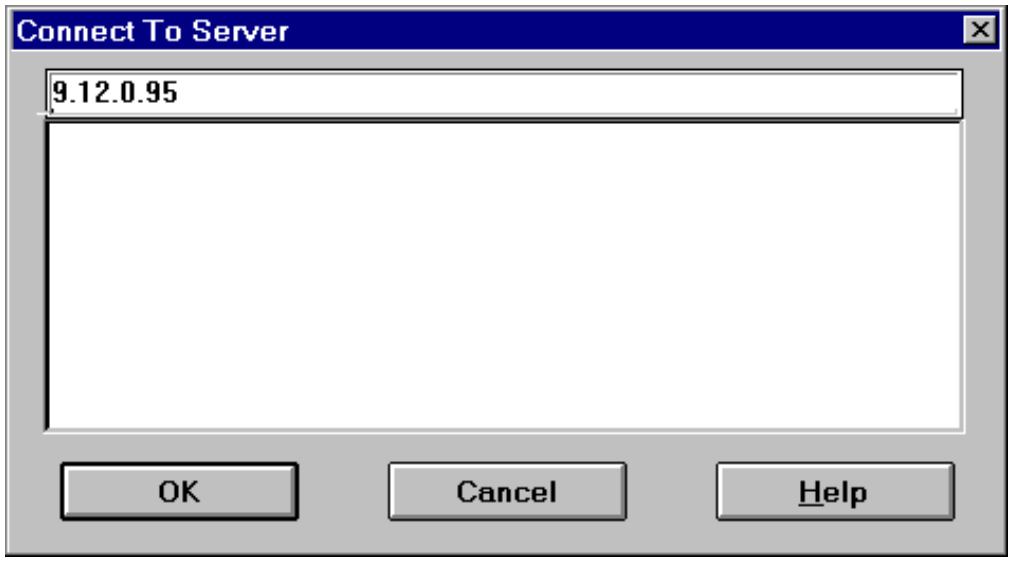

Figure 7. IP address of the RS/6000 that is the application server

Click **OK** and you will be presented with an AIX logon prompt. This is, in fact, a telnet connection to the RS/6000.

Logon to the AIX system as user ID lawson. Then enter the command `laenv` to start the Lawson environment process.

You will be presented with the following window to start administrating the Lawson database environment.

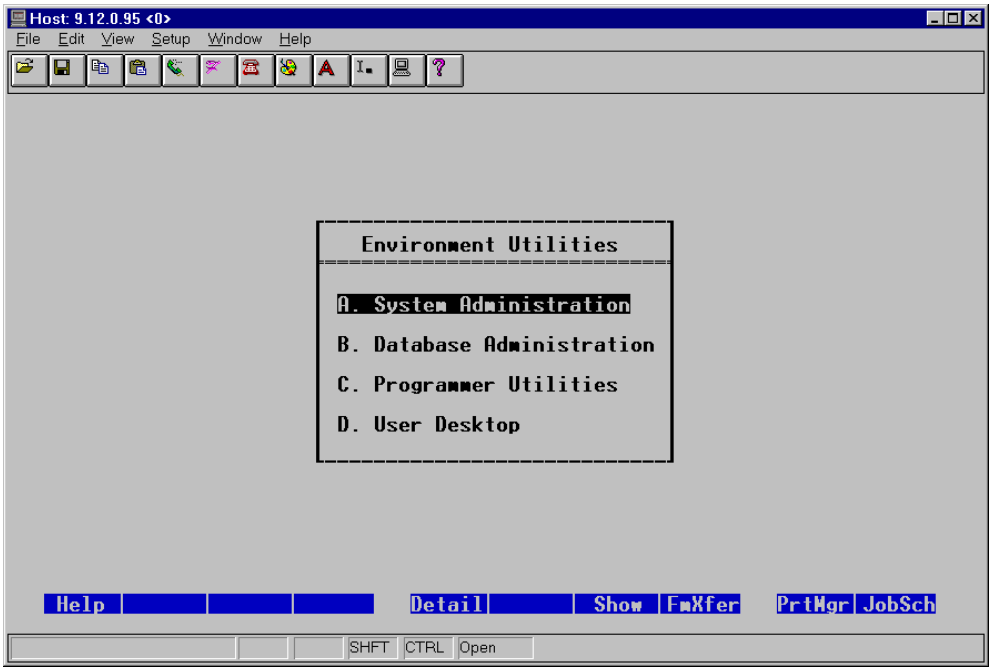

Figure 8. Lawson Environment Utilities

The next step is to choose **Database Administration** to prepare for the transfer of data from the Lawson environment to DB2 on OS/390.

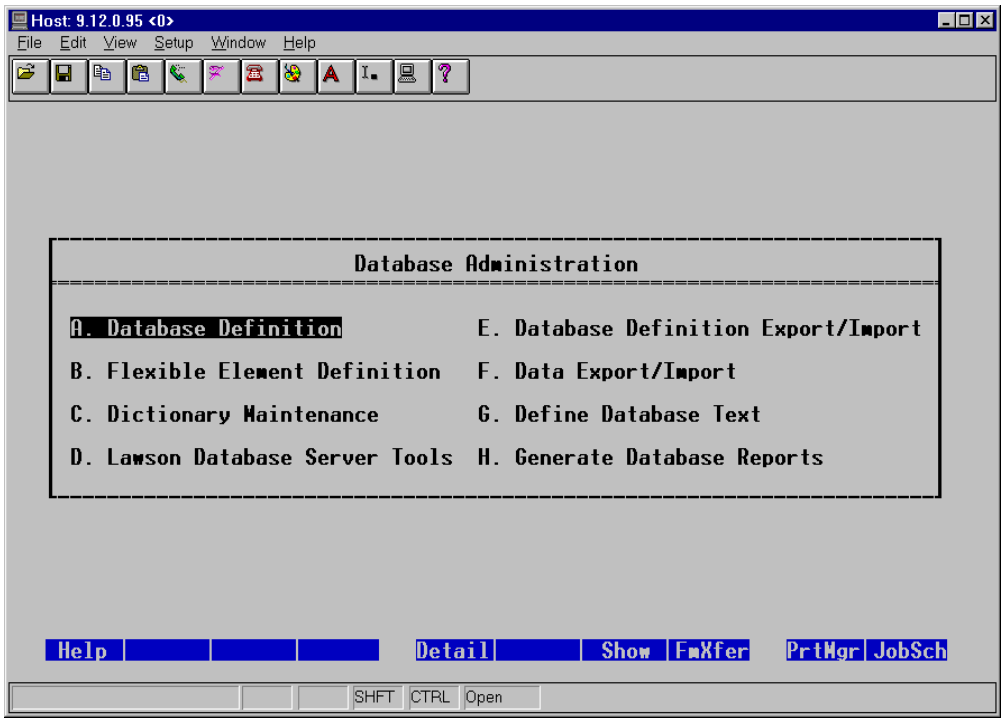

Figure 9. Database Administration

Choose **Data Definition** to set up the parameters for the Lawson DB2 environment. You will be presented with the window for the Product Line definition as shown in Figure 10.

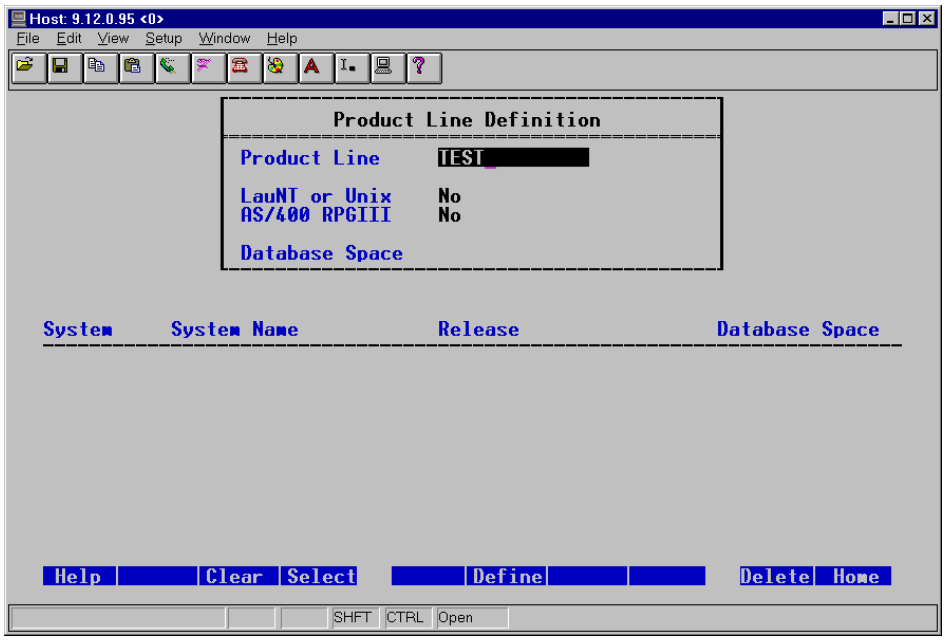

Figure 10. Product Line Definition

Note that the bar on the bottom represents the usage of the program function keys. PF4 is used to select values, PF6 is used to activate the define function.

Enter the Product Line that you want to define the database for. In our case it was TEST. The fields at the bottom of the window will be filled in with the system names that you have installed in TEST.

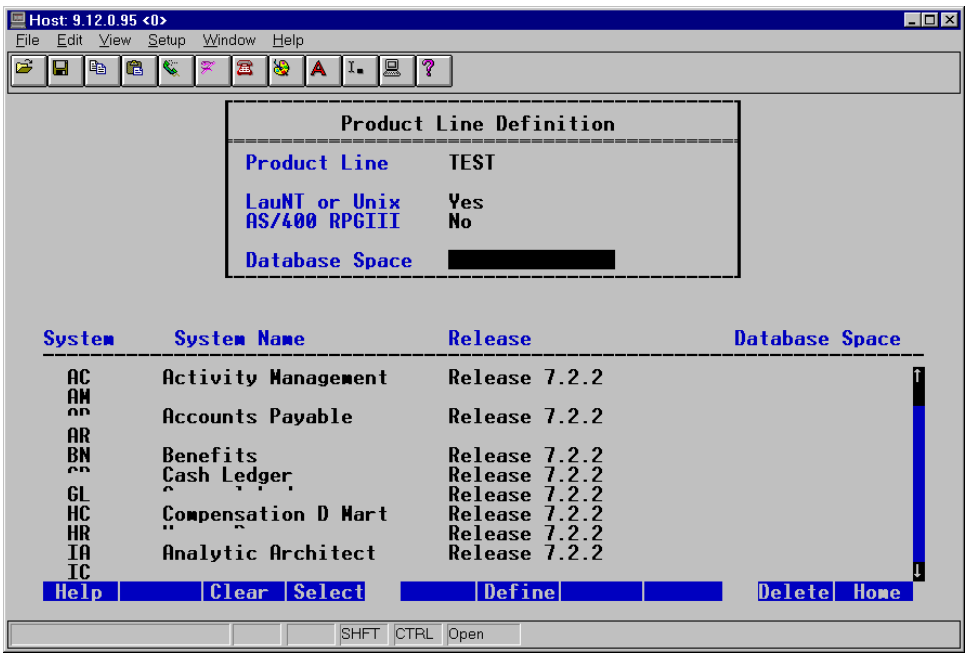

Figure 11. Product Line Definition - Database Space

Now move the cursor to the Database Space line in the Product Line Definition window and press PF6 to invoke the define function. The small Define Window will appear in the lower part of the screen as shown in Figure 12 on page 36.

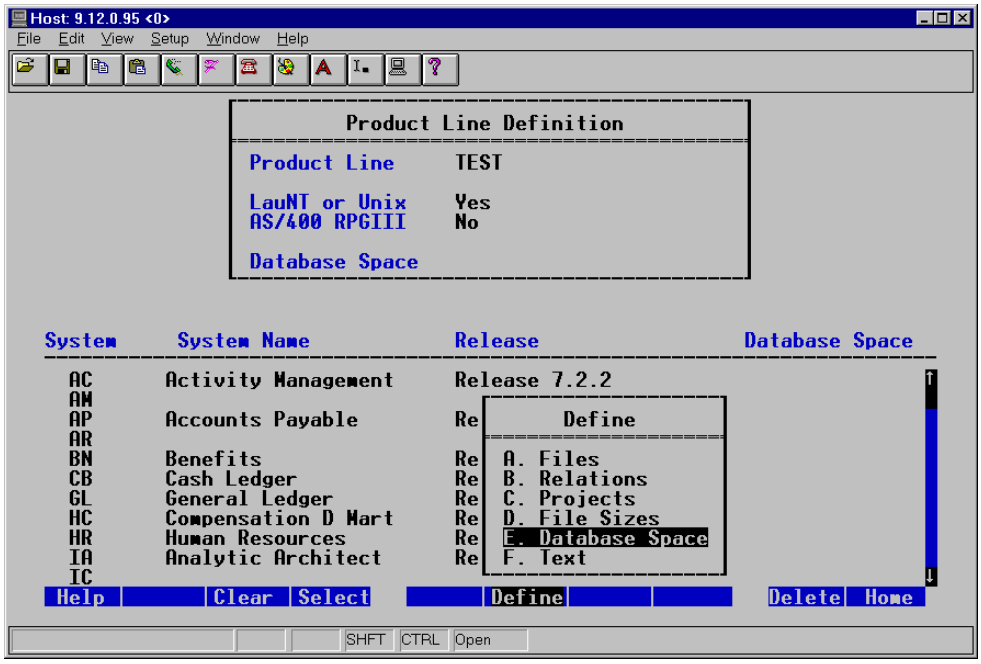

Figure 12. Define Window

Option D, Files Sizes gives you the opportunity to change the file sizes for your tables. We kept the default values for the file sizes.

Then we chose **E. Database Space** and the following window appeared:

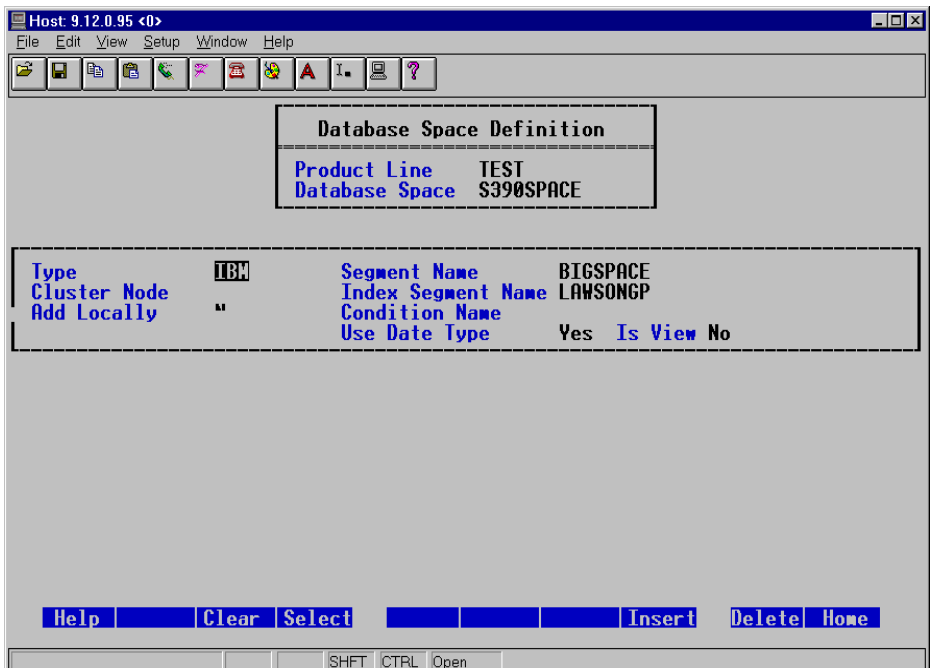

Figure 13. Database Space Definition

Enter the name of the Database Space you wish to define. This name does not have to relate to any DB2 name. In our test installation we only used one database space definition so we called it S390SPACE. Normally you would have many database space definitions, so you might want to match with the DB2 tablespace name to avoid confusion.

The Database Space Definition is used to connect the Lawson definitions to the DB2 definitions.

Move the cursor to the Type line and press PF4 to select the type field. Choose **IBM** for DB2 on OS/390. Then move the cursor to the Segment Name field and type in the DB2 tablespace name that you wish to used for this Database Space (in our case, it was BIGSPACE).

Then move the cursor to the Index Segment Name line and enter the DB2 stogroup name that the indexes should be created in. In DB2 for OS/390, indexes are not created in a tablespace but are allocated as VSAM files by using the create index command. The stogroup field in this command tells DB2 what DASD packs to use when allocating the VSAM files. (In our case, the stogroup name was lawsongp.) This field is only used for the stogroup if the Lawson table LAW_DBA_INDEX is not found.

Lawson enables you to change the size of the index files by creating a table LAW_DBA_INDEX. If this table is created, it is used for the index storage parameter. This is described in Chapter 12 of *Lawson Insight II - Enterprise Server Version 7.3.1*, November 1999, Document Number EES-731U.

Note: It is a good DB2 data management technique to have one stogroup for indexes and a separate one for the tablespaces. We only used one stogroup for our test installation.

Return to the window shown in Figure 9 on page 34 to select the Database Space to be used with this product line.

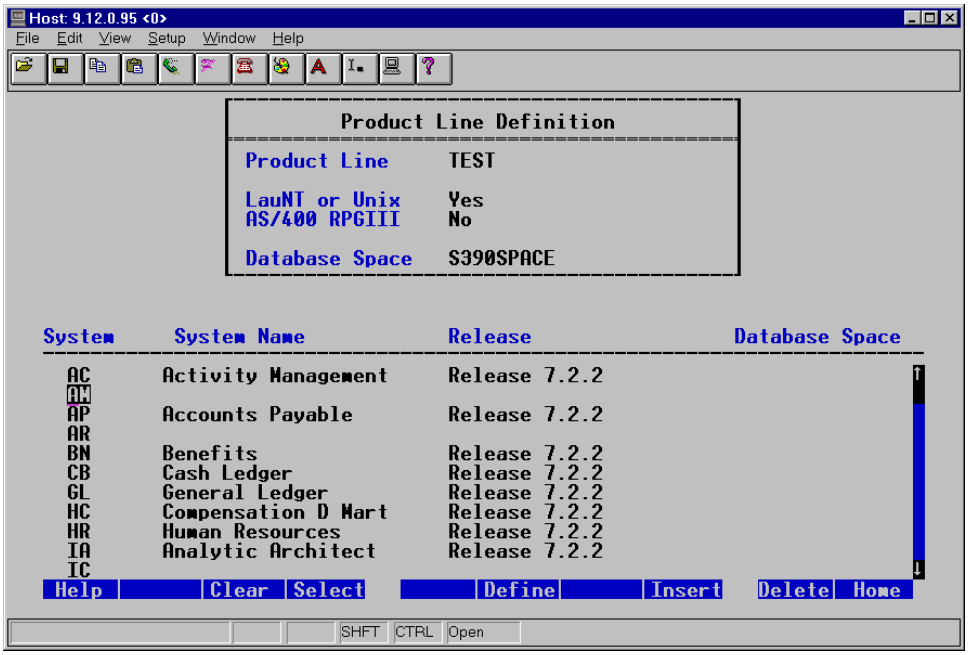

Figure 14. Selecting Database Space

Now that the Database Space has been defined, move the cursor to the Database Space line and press PF4 to select the Database Space to use for this Product Line definition.

Note: If you only enter the database space name (S390SPACE) at the top of the window, it will be used as the default for all the system names. If you have used good data management techniques and created many tablespaces and many database space definitions, you would enter the different database space names in the column on the right-hand side.

5.4.1 The Lawson Environment file

The Lawson DB2 driver uses the file $LAWDIR/*product line*/IBM to set up the connection to the DB2 on OS/390 database. It is important that these values be correct; otherwise, the connection will not work.

Since this file contains the OS/390 RACF user ID and password, the file should be protected with permissions set to 600.

The file /erp/lawson/test/IBM contains the values that the Lawson system uses in the ibmdb environment.

Our values were:

```
LAWGATENAME=ibmdb       database driver
DBNAME=db2blaw          DB2 connect name
DB2INSTANCE=db2inst1    name of DB2 instance installed with DB2Connect
DB390NAME=HRTEST1       database on S/390
LOGINNAME=LAWSON1       RACF user ID
```

```
PASSWORD=LAWSON         Racf password
```

5.5 Building the database definition

Now go back to the home screen as shown in Figure 9 and choose the **A. Build Dictionary** option. The next step is to build the data dictionary. This is the step that prepares the commands to build the tables and move the data to DB2 on OS/390.

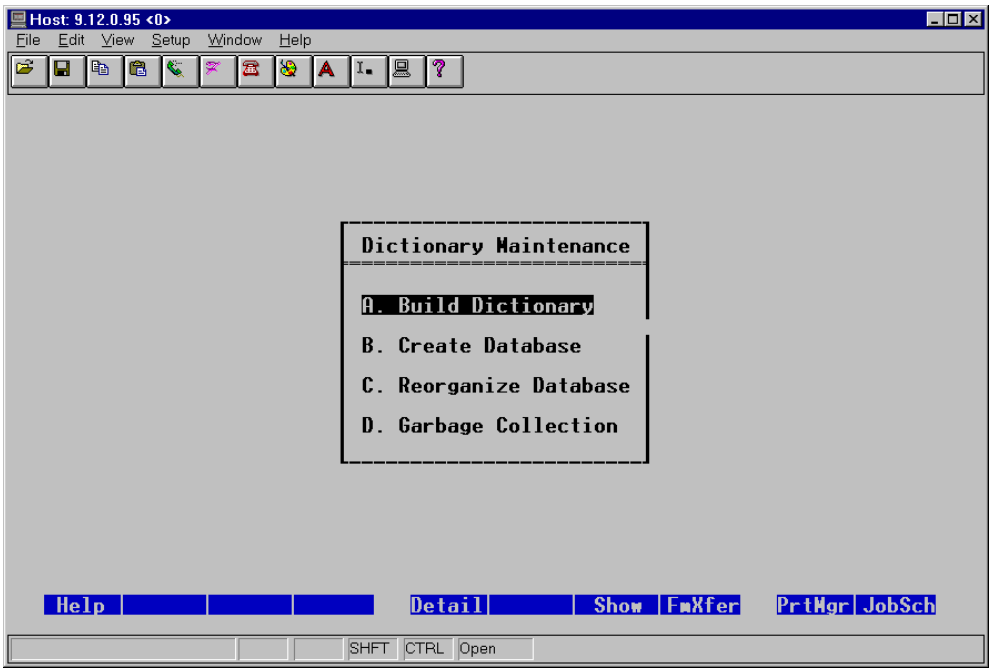

Figure 15. Build Dictionary

Enter the Product Line (in our case TEST), and press the Enter key for OK.

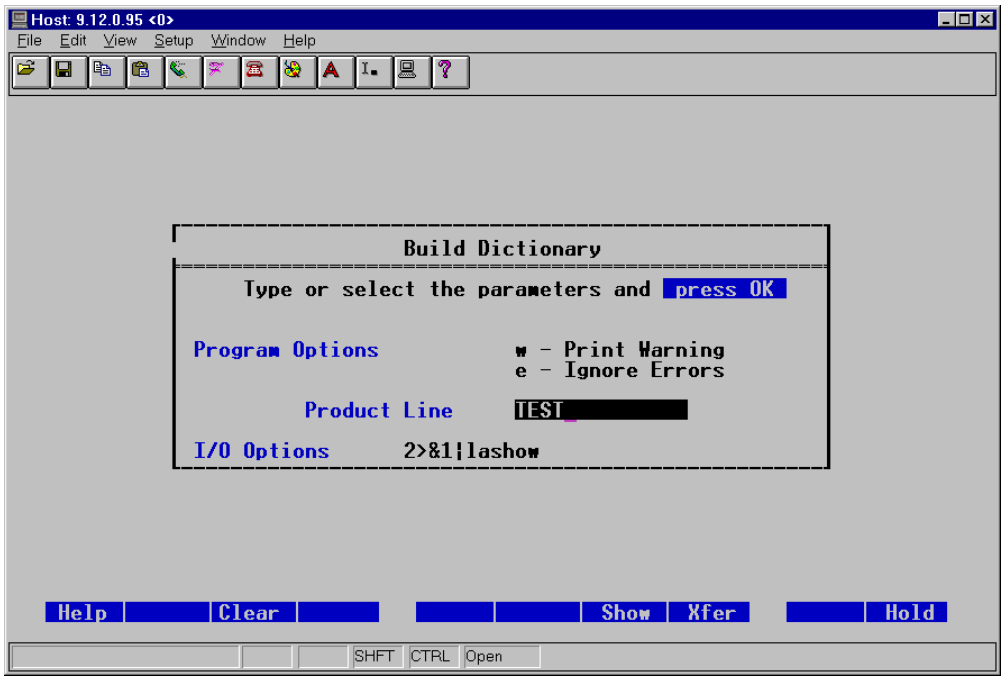

Figure 16. Product Line for Building Dictionary

In our case, we entered our Product Line name of TEST and pressed the Enter key to start the process of building the dictionary.

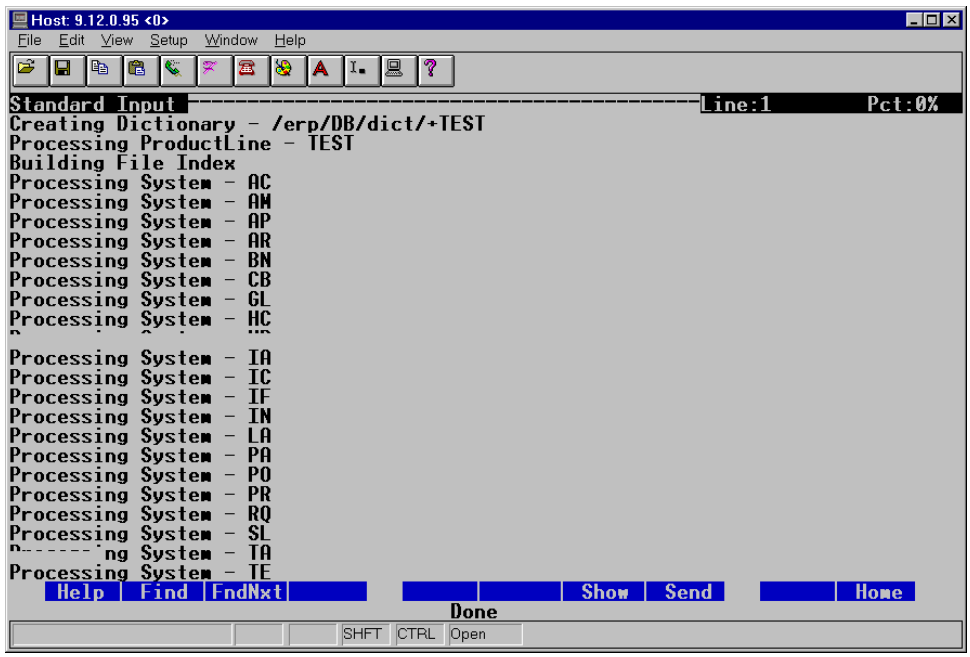

Figure 17. Creating Dictionary

The process to create the dictionary takes several minutes. When it is complete, the word Done will appear at the bottom of the window as shown in Figure 17.

This process can be run many times without any impact on the definitions. In fact, if you make any changes to the Dataspace Definition parameters such as tablespace names or stogroup names, you must rerun this process.

5.6 Reorganizing the database

When this process is complete, the next step is to reorganize the database. This is the step that actually creates the tables on DB2 on OS/390 and loads the data to the database.

Press esc to go back to the Dictionary Maintenance Menu and choose **C. Reorganize Database**.

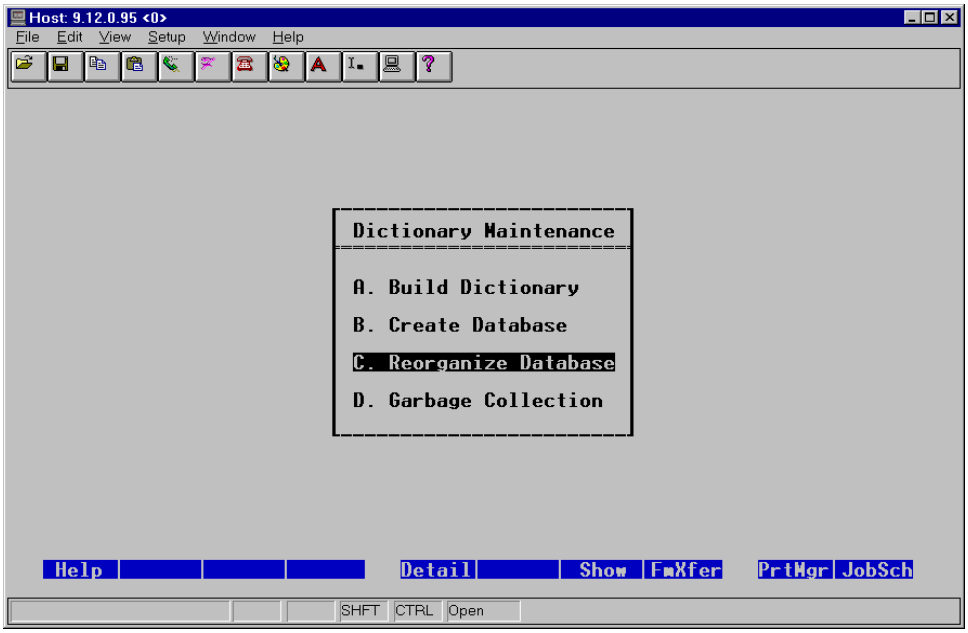

Figure 18. Reorganize Database

Enter the name of the product line that needs to be reorganized (in our case, it was TEST).

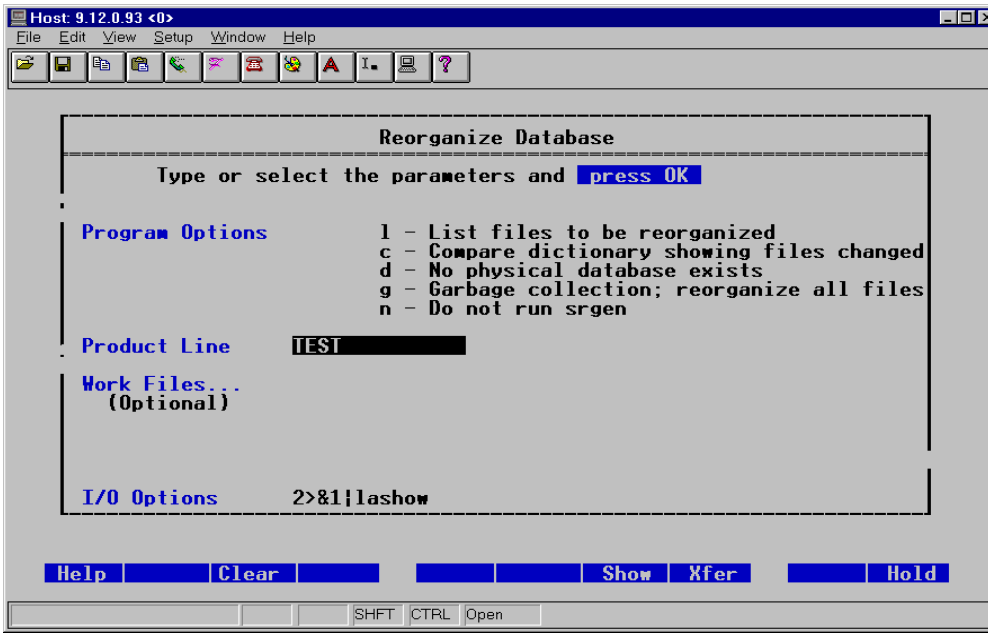

Figure 19. Choose product line to reorganize

This process takes some time to run. Messages will continue to appear as the database is being loaded as shown in Figure 20. This figure shows the messages we received when we were loading a product line called PRODUCTION.

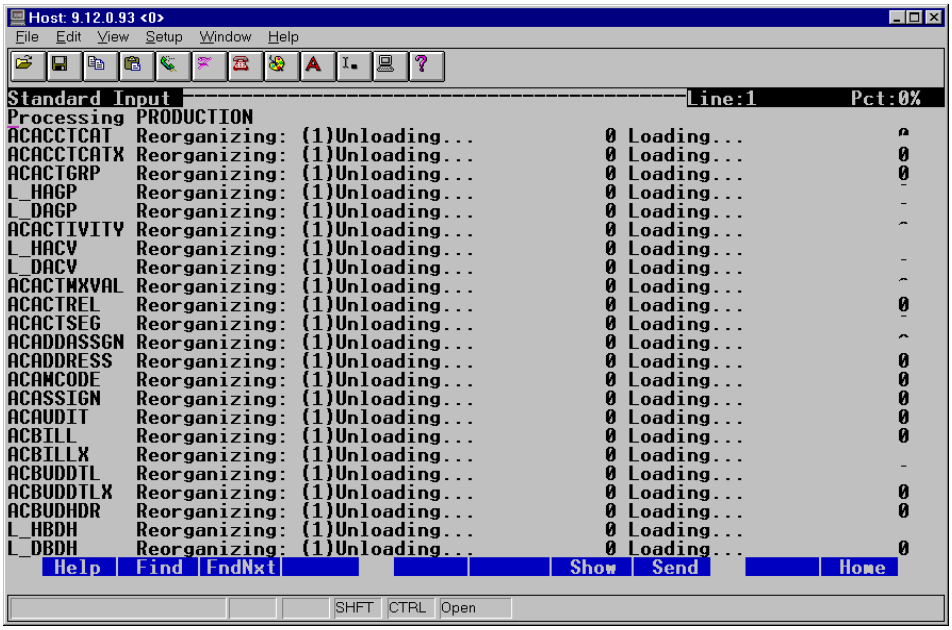

Figure 20. Loading the DB2 on OS/390 database for the PRODUCTION product line

When the loading of the DB2 database is complete, the word Done will appear at the bottom of the window.

5.7 Completing the database setup

To complete the setup of the DB2 database, it is recommended that the RUNSTAT utility be executed at this time. The JCL we used is listed in Appendix G, “JCL to execute RUNSTATS after the database is loaded” on page 99.

In addition, Lawson provides a verifyibm command that compares the structure of the Lawson environment on AIX to the one that is loaded in DB2 on OS/390. To use this command, go to the command line of the AIX system, logon as the user ID lawson and issue the following command:

```
verifyibm test
```

The output of this command showed us that our TEST product line was identical in the Lawson environment on AIX and in DB2 on OS/390, except that we were missing one table.

```
verifyibm test
Verifying objects for all Tables in the TEST Product Line:
Checking Table ACACCTCAT
Table ACACCTCAT not defined in database
Checking Table ACACCTCATX
Checking Table ACACTGRP
Checking Table L_HAGP
Checking Table L_DAGP
```

many lines not shown here

```
Total files found in the Productline  :  745
Foreign files found In the Productline:    0
Total Files unchecked/unable to open  :    0

Total Number of DB Files checked      :  745
Number of DB Files with no errors     :  744
Number of DB files missing            :    1
DB files with Incorrect definitions   :    0

Number of DB Indexes checked          : 2185
Number of DB Indexes with no errors   : 2185
Number of DB indexes missing          :    0
DB indexes with Incorrect definitions :    0
```

From this output we realized that we were missing the first table because, the first time we tried to connect to DB2 on OS/390, we had a mismatch in our DB2Connect parameters. The Lawson reorg utility, which creates the DDL, started on the second table when we reissued the reorg command, even though the first table was not created successfully.

To correct this we required help from the Lawson Center of Excellence. With their guidance, we then used a Lawson utility to create the DDL for the missing table.

We then used the ftp command to send this DDL to OS/390. Then we executed the DDL using SPUFI. We had to add the line `commit;` at the end of the file. When this DDL had run successfully, we reran the verifyibm test command. This was the output which showed the DDL was successful and the data dictionary for test on the Lawson environment matched the data dictionary for the database HRTEST1 on DB2B.

```
Total files found in the Productline  :  745
Foreign files found In the Productline:    0
Total Files unchecked/unable to open  :    0

Total Number of DB Files checked      :  745
Number of DB Files with no errors     :  745
Number of DB files missing            :    0
DB files with Incorrect definitions   :    0

Number of DB Indexes checked          : 2188
Number of DB Indexes with no errors   : 2188
Number of DB indexes missing          :    0
DB indexes with Incorrect definitions :    0
```

Note: If you have not granted sysadm authority to the `lawson` user ID, you will find that you need to grant select authority to the `lawson` user ID to access the SYSIBM.SYS*xxx* tables so the `verifyibm` command can be executed successfully.

5.8 Logging on from the Lawson Desktop Client

At this point, you are ready to logon as a Lawson client on the workstation.

Select **Start-->Programs-->Desktop Client**. Then, from the following menu, select **Desktop Client Logon**.

The initial logon window will appear. Enter the host name or the IP address of the RS/6000 or NT box that your Lawson environment is installed on. Enter the AIX user ID and password, then the product line and the application that you want to logon to.

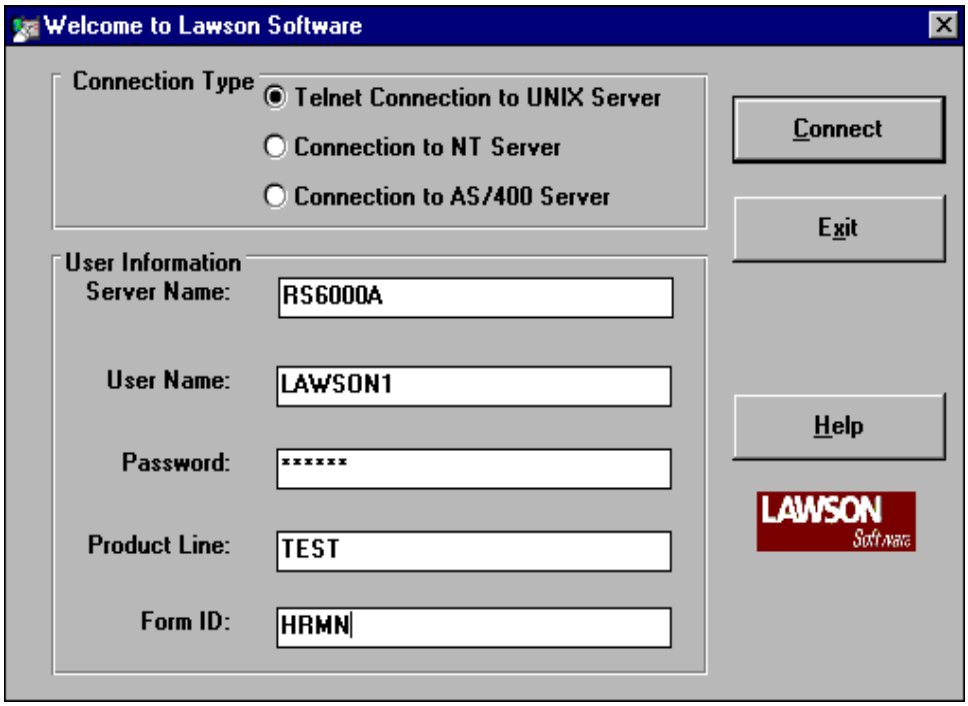

Figure 21. Lawson Client logon window

Click the **Connect** button and the first window of the Human Resources application appears as shown in Figure 22 on page 46.

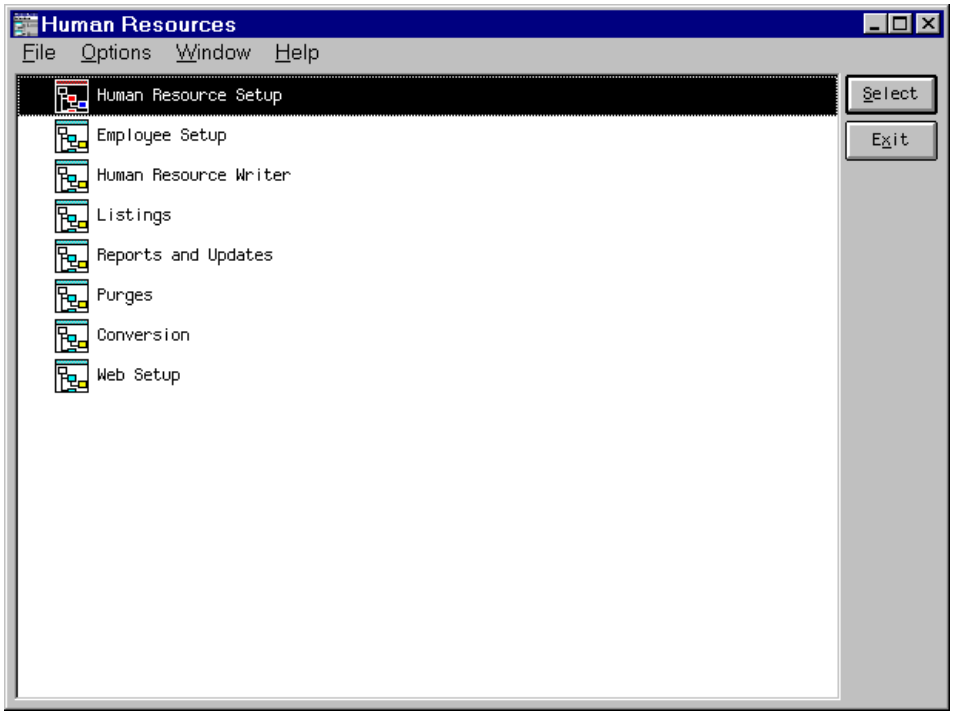

Figure 22. Lawson Human Resources Application

The installation of the TEST product line is now complete and functioning correctly.

Chapter 6. Setting up DB2 for a second product line

This chapter describes how we set up a DB2 for the OS/390 Lawson database with more tablespaces in our second installation.

6.1 Allocating more tablespaces

For our second installation, we set up two DB2 stogroups, one for tablespaces and one for indexes. We used the following DB2 commands to create the stogroups:

```
CREATE STOGROUP LAWSONG1 VOLUMES ('TOTLA2') VCAT DB2BLAW1;
CREATE STOGROUP LAWSONG2 VOLUMES ('TOTLA3') VCAT DB2BLAW2;
GRANT USE OF STOGROUPS TO PUBLIC;
COMMIT;
GRANT DBADM TO LAWSON2;
SET CURRENT SQLID=LAWSON2;

ALTER BUFFERPOOL (BP2) VPSIZE (1000)
```

We had already created HRTEST1 in the same DB2 subsystem with the creator ID of LAWSON1. The 745 Lawson tables were already present, so to have the same 745 tables in another tablespace for a second Lawson product line, we had to use a second creator ID. This meant that LAWSON2 had to have dbadm authority on DB2B and we had to change the user ID name in the $LAWDIR/training/IBM file.

We created one database again as it is a Lawson restriction that there can only be one database per product line:

```
CREATE DATABASE HRTEST2 BUFFERPOOL BP2 STOGROUP LAWSONG1;

COMMIT;
```

Then we created 7 tablespaces and divided the tables by application type.

We defined 7 database spaces using the Lawson Data Definition utility and allocated the tablespaces using the Lawson data definition facility.

```
/* for  AC AW  AP AR and BN      */
 CREATE TABLESPACE ASPACE  IN HRTEST2
 SEGSIZE 32 BUFFERPOOL BP1 LOCKSIZE ROW USING STOGROUP LAWSONG1
 PRIQTY  10000 SECQTY     10000 ;

 /* for CB and GL   */
 CREATE TABLESPACE GLSPACE  IN HRTEST2
 SEGSIZE 32 BUFFERPOOL BP2 LOCKSIZE ROW USING STOGROUP LAWSONG1
 PRIQTY  10000 SECQTY     10000           ;

/* for HC and HR          */
 CREATE TABLESPACE HRSPACE  IN HRTEST2
 SEGSIZE 32 BUFFERPOOL BP2 LOCKSIZE ROW USING STOGROUP LAWSONG1
 PRIQTY  10000 SECQTY     10000           ;

/* for IA IC IF and IN  */
 CREATE TABLESPACE IASPACE  IN HRTEST2
```

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```
 SEGSIZE 32 BUFFERPOOL BP2 LOCKSIZE ROW USING STOGROUP LAWSONG1
 PRIQTY  10000 SECQTY     10000           ;
 COMMIT ;

/* for LA PA PO PR RQ and SL  */
CREATE TABLESPACE PASPACE  IN HRTEST2
 SEGSIZE 32 BUFFERPOOL BP2 LOCKSIZE ROW USING STOGROUP LAWSONG1
 PRIQTY  10000 SECQTY     10000 ;

/* for TA TE TM TP TX  */
CREATE TABLESPACE TASPACE  IN HRTEST2
 SEGSIZE 32 BUFFERPOOL BP2 LOCKSIZE ROW USING STOGROUP LAWSONG1
 PRIQTY  100000     SECQTY     100000    ;

/* for UG US and WF  */
CREATE TABLESPACE UGSPACE  IN HRTEST2
 SEGSIZE 32 BUFFERPOOL BP2 LOCKSIZE ROW USING STOGROUP LAWSONG1
 PRIQTY  10000 SECQTY     10000 ;

COMMIT;
```

Then we had to enter the tablespace names in the data definitions in the Lawson environment on AIX.

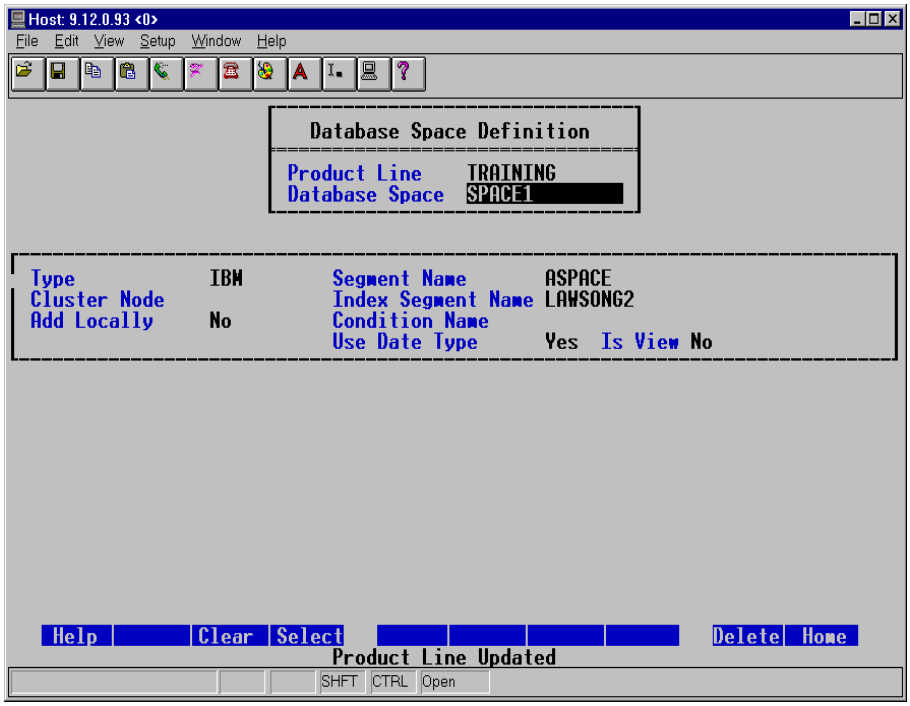

Figure 23. Defining ASPACE to Lawson

These new definitions were used in the build dictionary function of Lawson. Then the Lawson reorg function loaded the data into the HRTEST2 tablespace and created the indexes using stogroup LAWSONG2.

Our definitions were as listed:

Lawson name	DB2 Name
SPACE1	ASPACE
SPACE2	GLSPACE
SPACE3	HRSPACE
SPACE4	IASPACE
SPACE5	PASPACE
SPACE6	TASPACE
SPACE7	UGSPACE

We entered the Lawson names as shown in Figure 24:

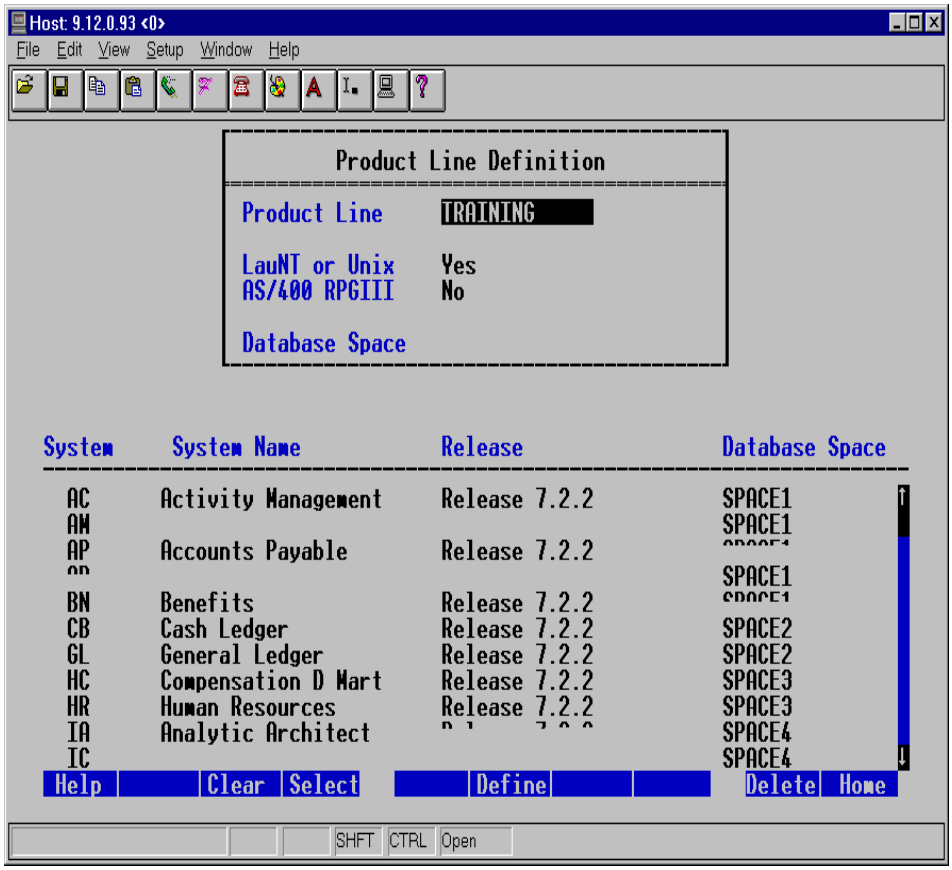

Figure 24. Product line definition with several tablespaces

Then we had to complete the process by running the build data dictionary and reorganize the database as described in “Building the database definition” on page 39 and “Reorganizing the database” on page 41.

Chapter 7. Administration of Lawson Applications on DB2 OS/390

This chapter reviews a collection of DB2 data administration topics from the following sources:

- Lawson installation experience
- Interviews with customers who have installed Lawson to run with DB2 on a System/390 platform
- DB2 experience

Over the years, we have worked with customers who have installed applications similar in architecture to Lawson Insight.

7.1 DB2/Lawson Insight introduction

There are some basic characteristics of the Lawson Insight implementation that must be presented for you to understand the reasons for some of the DB2/Lawson Insight recommendations in this chapter.

DB2/Lawson Insight indexes
None of the Lawson Insight indexes are explicitly defined as clustering. This has a profound effect on our recommendations regarding the Reorg utility.

Lawson's use of SQL
Given the Lawson database, experience suggests that you can expect Lawson Insight to place DB2 under relatively light stress. You can anticipate relatively straightforward SQL that DB2 optimized long ago. Our experience indicates that you are likely to see the major share of resource consumption in the Lawson Insight environment come from components outside of DB2.

7.2 DB2/Lawson Insight operational observations

We recommend that you plan to run Lawson Insight on a dedicated DB2 subsystem. This will position you to implement upcoming recommendations, specifically those addressing point-in-time recovery.

7.3 DB2/Lawson Insight database and tablespace recommendations

The Lawson installation procedure requires installation of one database for each product line. The first time we used only one tablespace. The second time we used seven tablespaces. The division was based on the first two characters of the table name, which indicate the type of table. This is described in "Allocating more tablespaces" on page 47.

Lawson support can provide you with a document for a tablespace configuration that is based on their knowledge of the use of the tables.

Ultimately, the tablespace design will be customer-dependent and change continually based on the analysis done by the DBA and ongoing tuning.

7.4 DB2/Lawson Insight DSNZPARM recommendation

This recommendation should be considered as a starting point. Of course, if you have unique processing requirements, you may choose a different value for the following parameters:

1. LOGLOAD

   We recommend that you set LOGLOAD to 50,000. LOGLOAD specifies the number of DB2 log records written between DB2 checkpoints. The higher LOGLOAD, the less frequently DB2 takes checkpoints.

   This recommendation centers around two factors:

   - DB2 restart time

     If DB2 abnormally terminates, the restart time is a function of the number of log records that DB2 must process. At restart time, DB2 will generally go back one checkpoint and then process to the end of the log. A lower LOGLOAD means less log to process at restart, and consequently a faster restart in general. Of course, a long-running unit of recovery that takes few or no commits could cause a greater amount of log processing at restart.

   - DB2 writes from buffer pools to DASD

     When DB2 takes its internal checkpoint (a function of LOGLOAD), it schedules I/O for updated pages in the buffer pools to DASD. As LOGLOAD increases, the number of pages to be written tends to increase. With large buffer pools and a large LOGLOAD, the write activity can be significant (this activity is sometimes noticeable by users who perceive periods of slower than normal performance). You can control the write load with the DWQT and VDWQT threshold parameters discussed earlier, or as an alternative, you can minimize exposure to an excessive write load with a smaller value for LOGLOAD.

2. EDM pool

   We recommend that you configure your EDM pool at 100 megabytes. The EDM pool contains:

   - DBDs
   - Plan/Package skeleton cursor tables
   - Cached authorization IDs
   - Cached dynamic plans

7.5 DB2/Lawson Insight buffer pool and free space allocation

This section covers buffer pool and free space recommendations.

7.5.1 DB2/Lawson Insight buffer pool recommendations

The following are general recommendations regarding configuration of the DB2 buffer pools in support of Lawson Insight. The recommendations are not based upon specific Lawson Insight experience, but upon experience with applications of similar architecture. The recommendations assume that the DB2 subsystem is dedicated to Lawson Insight, and are presented as percentages of the number of buffers you are willing to assign to the DB2 buffer pools.

- BP0 - 10%. Restrict BP0 to the DB2 catalog and directory. This is to facilitate the dynamic SQL that Lawson Insight executes.
- BP10 - 35%. BP10 is to support Lawson Insight tables.
- BP11 - 50%. BP11 is dedicated to Lawson Insight indexes. Indexes tend to have a high buffer reuse. Consequently, we recommend a high buffer allocation.
- BP7 - 5%. BP7 is to support DB2 temporary storage (DSNDB07).

  We have not seen extensive use of the DB2 sort work files running the Lawson Insight applications. 5% is considered a “safe” allocation of buffers to support the use of DSNDB07. You will want to track DB2 instrumentation statistics regarding this buffer pool. You may add some query workload or use parts of the Lawson Insight applications that we did not test. Either of these could cause you to increase the buffers allocated to DSNDB07.
- BP32 - minimum. This is support for any 32 K buffer pool requirement.

Except for BP0, a specific buffer pool number is arbitrary. Note, however, that DB2 requires BP0 for the catalog and directory table spaces. Obviously you may, for example, use BP2 to support DSNDB07. The key is the concept centering on differentiating buffer pools for tables and indexes.

7.5.2 DB2/Lawson Insight free space recommendations

Both PCTFREE (percent of a page that is kept free at Load or Reorg time) and FREEPAGE (interval at which a page of free space is to be inserted during Load or Reorg) apply to tablespaces and indexes.

- Lawson Insight/DB2 tablespaces

  We recommend that you explicitly set PCTFREE to 0. You may accept the default of 0 for FREEPAGE.

  None of the Lawson Insight tables have indexes that have been explicitly defined as clustering. The implication of this is that there is no benefit to having DB2 attempt to maintain the table’s data in a sequence. Even if you do not explicitly define a clustering index, DB2 will attempt to sequence the data at SQL insert time by the sequence of the first defined index. This is not likely to be of any value during processing.

  Zero for PCTFREE and FREEPAGE will save DASD. You may be concerned about insert processing contention at the end of the table. That is not a problem. DB2 in this case will attempt to find the “best page” for the insert (it will be the last page without any free space) and if DB2 cannot get that page, it will get another page “near the best page”. In effect, do not worry about insert contention in this recommended no-free-space environment.
- Lawson Insight/DB2 indexes

  For indexes, the default of 10% for PCTFREE should be maintained. An index has the characteristics of a sequential data set. DB2 can more efficiently maintain an index’s sequence with free space.

  We do not have a specific recommendation for FREEPAGE. In general, you should consider free pages when insert activity is high against a table. You will have to track insert activity in your environment.

7.6 DB2/Lawson Insight reorganization and RUNSTATS recommendations

Following are considerations for the use of the DB2 Reorg and Runstats utilities in support of Lawson Insight data.

Reorg strategy

1. In general, run Reorg Lawson Insight table spaces infrequently. Lawson Insight tables are not defined with clustering indexes explicitly defined. The Reorg utility will not resequence a table that does not have a clustering index explicitly defined. The Reorg utility could reestablish free space, but it was recommended that you define no free space on Lawson Insight tablespaces. Given the fact that the Lawson Insight tables have no explicitly defined clustering index and there will be no free space (if you elect to implement that recommendation), Reorg will be of no value.

   However, there is one case where Reorg may provide some benefit. The application-related processing sometimes requires that new data be inserted at the end of the table, while aged data is deleted from the front of the table. If the key is ascending, it is possible that deleted space in the front of the table is not reused. In this case, Reorg will reclaim the space left from deletions in the front of the table.

2. Evaluate the use of the online Reorg feature of DB2 V6 when you determine that the running of Reorg can benefit your environment. There would be some benefit if you needed to reclaim space left by deletions of rows from the table. Online Reorg significantly reduces the impact of this planned outage. The online Reorg utility copies the tablespace to one or more shadow data sets where the actual reorganization is done. The DB2 log is applied in an iterative fashion to the shadow copy of the data to synchronize it with the actual online tablespace.

   After the log is applied, the shadow data replaces the unorganized data when the Reorg utility changes data set names. The outage is now limited to read-only during the final application of the DB2 log to the shadow copy of the table space, and no readers or writers are allowed during the changing of the shadow data set names to the active tablespace data set names.

3. Reorg DB2 indexes on a periodic basis.

   Since indexes have the characteristics of sequential data, there is benefit to Reorg-ing or resequencing them. There are many indexes defined in the Lawson Insight applications; however, it is not necessary to Reorg them all. We recommend that as a starting point you Reorg, on a monthly basis, indexes that are in multiple extents. You can then refine your index Reorg strategy based upon your experience with the Lawson Insight applications.

Runstats strategy

1. Run Runstats on the Lawson Insight/DB2 objects prior to going into production. After going into production, run Runstats infrequently.

   Most of the Lawson Insight indexes are defined as unique. Consequently, the one-to-one relation of index key to data row (which is what Runstats determines) will not change. Therefore, one execution of Runstats will provide DB2 index cardinality data that cannot change for the unique indexes over time (that is, the one-to-one mapping cannot change). There are some non-unique indexes defined on Lawson tables. These indexes can benefit from infrequent Runstats.

7.7 DB2/Lawson Insight index usage

We recommend that you define all indexes on Lawson Insight tables to be type 2 indexes. This will reduce locking and position you for DB2 Version 6, which has dropped support for type 1 indexes.

7.8 DB2/Lawson Insight point-in-time recovery recommendations

The usual reason for a point-in-time recovery is an application programming error or a flawed operational procedure. Unfortunately, this exposure is always present, regardless of your hardware/software configuration. Additionally, a point-in-time recovery has the potential to be the most disruptive outage you are likely to encounter.

The reason is that in a Lawson environment, you may need to recover all objects to a prior point in time. Depending on how you have mapped your tables to tablespaces, this could mean from 20 to over 1,000 tablespaces to recover, along with a few thousand indexes. Your usual point-in-time recovery techniques, which you probably regard as conventional at this time, may be insufficient in this environment.

The point-in-time recovery environment will be addressed as follows:

- Point-in-time recovery preventive measures
- Point-in-time recovery techniques
- Point-in-time recovery considerations

7.8.1 Point-in-time recovery preventive measures

A failure in application development (introducing a programming defect), or in operational procedures (perhaps by running a job twice), introduces the requirement for point-in-time recovery. The available preventive measures consist of increased attention to:

- Change management
- Problem management
- Testing

Each of these disciplines is procedure-oriented and management-driven. As attention to these disciplines is increased, the need for point-in-time recovery usually decreases. Unfortunately, the need for point-in-time recovery is never entirely eliminated. Consequently, you will want to make every effort to avoid having to do a point-in-time recovery, but you should be prepared to do one if required.

7.8.2 Point-in-time recovery techniques

The concept behind point-in-time recovery is well understood. It usually involves resetting a table or group of tables to a prior point in time when data was determined to be consistent. The challenge in the Lawson environment is determining the set of tables that are logically related. It is possible that you will not be able to determine a subset of the Lawson tables to be reset. You will likely be required to reset all Lawson tables to a prior point of consistency.

There are several techniques to effect a point-in-time recovery including:

- Point-in-time recovery using user-written application programs
- Point-In-time recovery using DB2 utilities

  The DB2 Quiesce and Copy utilities are the primary tools.
- Point-in-time recovery using a dump/restore scenario

  This scenario typically employs non-DB2 utilities.
- Point-in-time recovery using a DB2 conditional restart

  Any conditional restart scenario is potentially risky. The benefit of this scenario is the “effectively free” establishment of the point of consistency.
- Point-in-time recovery using suspension of DB2 update activity

  DB2 update activity is suspended using the SET LOG command to SUSPEND/RESUME logging. This function was introduced into DB2 Version 6 with APAR/PTF - PQ31492/UQ36695.

7.8.3 Point-in-time recovery using user-written applications

This is a strategic direction and not a scenario. It acknowledges that data can be corrupted due to program errors. If this happens, you may attempt to correct the contaminated data with application programs. If you fail to correct the data with application programming, a scenario such as one of those following could be used as a last resort. This approach is gaining favor among users striving for high availability.

In implementing an approach like this, it is important to determine which transactions will make the data more corrupt or will propagate the errors. This information then can either be communicated to the end users, or the DBA can use it to disable the dangerous transaction.

7.8.4 Point-in-time recovery using DB2 utilities

The scenario for a point-in-time recovery using DB2 utilities is:

- Determine the set of tables that are logically related.

  Typically this is a subset of the tables that make up the application database. However, it may consist of all Lawson tablespaces and indexes.
- Optionally, execute the QUIESCE utility on all the tables that are candidates to be reset if a point-in-time recovery is required.

  This establishes a point of consistency and causes the DB2 buffers for the quiesced tables to be externalized to DASD.
- Execute the COPY utility on all the tablespaces that are candidates to be reset if a point-in-time recovery is required.

  The obvious reason for this step is to back up the data. However, COPY will fail if it cannot externalize the DB2 buffers to DASD. That is the reason we invoked the QUIESCE utility first (to remove one reason why COPY may fail).

  You may want to place your Image Copy output on DASD. With DB2 V6.1, DASD-resident image copies enable parallelism in both the COPY and RECOVER utilities.
- For the second time, execute the QUIESCE utility on all of the tables that are candidates to be reset if a point-in-time recovery is required.

This invocation of QUIESCE will establish a log RBA which will be the point of consistency.

- When it is necessary to recover to this point of consistency, RECOVER to the RBA established by the second invocation of the QUIESCE utility.

  With the combination of the COPY and the second QUIESCE, the RECOVER TORBA will perform as efficiently as a Recover TOCOPY would perform, assuming no logging during the execution of this scenario.

- When it is necessary to recover to this point of consistency, RECOVER all indexes on all of the tables that have been reset to the prior point of consistency. The indexes must be synchronized with the data in the recovered tablespaces. DB2V6.1 added the functional capability to recover the index from an image copy. The recovery of the index from an image copy in V6 is a significant performance benefit over prior versions of DB2 that rebuild the index (this includes reading the table to unload and construct all keys, sorting the keys, and then rebuilding the index).

The benefits of this scenario are:

- There is minimal disruption to the user in preparing for the scenario. The user may see some slowness in response during the execution of the QUIESCE utility, but this can likely be scheduled during off-hours to minimize the disruption.
- There is no disruption to the user when COPY is run with Share-Level Change. COPY - Share-Level Change allows updates concurrent with utility execution.
- The recovery of the tablespaces will be efficient. RECOVER TORBA will perform as well as RECOVER TOCOPY, assuming no logging between the execution of the COPY utility and the second execution of QUIESCE.

However, there is a significant disadvantage to this scenario.The requirement to recover thousands of objects may take too long, making this scenario impractical. If you are evaluating the use of this scenario, time it to determine if it meets your availability requirements.

7.8.5 Point-in-time recovery using dump/restore utilities

This scenario uses a DB2 command and usually a non-DB2 dump/restore utility program:

- Determine the set of tables that are logically related.

  Typically, this is a subset of the tables that make up the application database. However, in the Lawson environment, it may be all of the tables.

- Use the DB2 STOP DATABASE command to stop all of the tablespaces that are logically related.

  The STOP DATABASE command will cause the DB2 buffers to be externalized to DASD, and will cause the VSAM data sets that hold the DB2 data to be closed. While the tablespaces are stopped, the data will be unavailable to users. You may evaluate bringing down DB2 as an alternative to the STOP DATABASE command.

- Dump the tablespace and index data sets using your installation's high-speed dump utility.

You may consider using FlashCopy or SnapShot to dump the data sets. The dumped data sets represent your point of consistency.

- When it is necessary to recover to this point of consistency, stop DB2, restore the data sets that were dumped in the previous step, and then restart DB2.

  Because the tablespaces were stopped when backed up, there were be no outstanding units of recovery, and the data was consistent. The restored data consists of both the tablespaces and the associated indexes.

The recovery portion of this scenario is faster than the previous one, but preparing for it is more disruptive to the user. The data is unavailable to the user while the tablespaces are stopped and while the data is being dumped. The length of time that data is unavailable can be lessened by using FlashCopy or SnapShot.

7.8.6 Point-in-time recovery using DB2 conditional restart

The following scenario will likely appeal to the more experienced DB2 user. The scenario requires a DB2 conditional restart, which is a part of DB2 not frequently exercised by users. Its key advantage is an “almost free” establishment of a point of consistency.

At a high level, the scenario may be defined as follows:

1. Identify a set of candidate points of consistency.
2. Select that candidate point of consistency which best meets your requirements.
3. Make that best candidate point of consistency into a true point of consistency.

   This is the point at which you will do the conditional restart. The conditional restart will make your candidate point of consistency the true point of consistency on the DB2 Log.
4. Recover all tablespaces to the true point of consistency.

   The conditional restart will position you to recover all of your tablespaces. Because of it, you will use RECOVER to currency (not RECOVER TORBA).
5. Now RECOVER all indexes on all the tables that have been reset to the point of consistency.

   The indexes must be synchronized with the data in the recovered tablespaces.

The first three steps listed are new and will receive the major part of our attention here. Once those steps have been completed, the remainder of this scenario is conceptually similar to the later steps of the scenario “Point-in-time recovery using DB2 utilities” on page 56, with the difference that you will recover to currency and not to an RBA.

Identify a set of candidate points of consistency

Consider a list that contains many items (or rows). Each list item has two entries in columns: the first column is a timestamp, and the second column is the DB2 Log RBA associated with that time. The list can be quite long (that is, showing many timestamps). This list of timestamps is our set of candidate points of consistency.

The list might have an entry for each hour in the day or for each minute in the day. For each entry in the list, you have a timestamp and the corresponding DB2 Log RBA. This allows you to map a specific time to a DB2 Log RBA.

How do you build a list of timestamps and the associated Log RBAs? You start by defining a dummy database and tablespace. This will be a real DB2 database and tablespace, but there will be no activity against the dummy tablespace. The Lawson application will not know about this tablespace.

Once the dummy tablespace is defined, you will initiate a user-developed procedure that will periodically QUIESCE that dummy tablespace. Since you will allow no activity against the dummy tablespace, the QUIESCE will be very fast. It will cause the Log RBA and the timestamp to be entered into SYSIBM.SYSCOPY. These entries for the dummy tablespace make up your list of candidate points of consistency. If you do the QUIESCE each hour, there will be an entry for the dummy tablespace in SYSIBM.SYSCOPY each hour.

Note that the defined dummy table is *only* used as an aid in determining an RBA in the log that corresponds to a given time. It is possible to calculate the RBA without the dummy table, but the calculation is complex; use of the table is simpler and less prone to error.

Best point for consistency
Select the candidate point of consistency that best meets your requirements.

Suppose you determine that because of an application programming error, data in your Lawson system is inconsistent. This part cannot be automated. You must determine when the inconsistencies began to enter your system. Suppose you determine that at 5:00PM on January 14, 2000, erroneous data began to enter your system. You make the determination that you want to take your system back before that date and time.

You have one more task: Query SYSIBM.SYSCOPY for the dummy tablespace entry before 5:00PM on January 14, 2000. Once you determine that entry from the list, note the DB2 Log RBA.

Where do you stand now? You have the Log RBA of the nearest time before the inconsistencies entered your system. You are now ready to make that Log RBA, which relates to a candidate point of consistency, a true point of consistency.

True point of consistency
Make the best candidate point of consistency into a true point of consistency.

There is probably data inconsistency at the Log RBA you identified. You are running an active Lawson system and it is likely that at the time you have identified, there was work in progress (including in-flight units of recovery). However, you can make that Log RBA a true point of consistency.

By doing a DB2 conditional restart, you can make the Log RBA you identified into a point of consistency. You will use the CHANGE LOG INVENTORY DB2 utility to create a conditional restart control record using the following statement:

```
CRESTART CREATE,FORWARD=YES,BACKOUT=YES,ENDRBA=XXXX
```

where XXXX is the true point of consistency you determined from your SYSIBM.SYSCOPY query.

The conditional restart will cause DB2 to truncate the log at your true point of consistency. Log entries beyond that point will be disregarded. Additionally, DB2 will remove from SYSLGRNGX and SYSCOPY any entries that occurred after the true point of consistency.

Recover all tablespaces to the true point of consistency
After the conditional restart, this will be a recovery to currency and not a recovery to an RBA (recovery to an RBA is common in most point-in-time recovery scenarios).

Recover all indexes to the true point of consistency
All indexes on the tables that have been reset must be recovered to the prior point of consistency. The indexes must be made consistent with the data.

7.8.7 Point-in-time recovery using suspension of DB2 updating

This scenario is functionally similar to the scenario “Point-in-time recovery using dump/restore utilities” on page 57. The salient features of both scenarios are:

- Determine the set of objects requiring backup and recovery.
- Stop processing.
- Dump the set of objects.
- Restore the set of objects and restart DB2.

The unique characteristic of the "Point-in-time recovery using suspension of DB2 updating" scenario is a new technique to stop DB2 update processing. The specific characteristics of this scenario are:

- Determine the set of objects requiring backup and recovery.

  The issues for this step are the same for all point-in-time recovery scenarios using Lawson. You will likely back up your entire Lawson system.

- Stop processing.

  The unique feature of this scenario is the method for stopping the processing. APAR/PTF - PQ31492/UQ36695 provides the ability to "suspend" and "resume" DB2 logging. This has the effect of “freezing” updates to your DB2 data while you make copies of the DB2 data and the DB2 log. Specifically, after logging is "suspended", the DB2 log and the data are consistent. When the SET LOG SUSPEND command is issued:

  - A system checkpoint is taken. The scope of the command is single system only. In a data sharing environment, the command will have to be entered for each member.
  - Unwritten log buffers are externalized to DASD.
  - The BSDS is updated with the high-written log RBA.
  - A log-write latch is obtained to prevent further logging. Logging is suspended until the "resume" command is entered.

- Dump the set of objects.

  To take maximum advantage of this scenario, you will want a high-speed dump capability like FlashCopy or SnapShot. With this scenario, you will add the DB2 log to your list of objects to be dumped. The function of the APAR discussed earlier makes the log consistent with the DB2 data.

- Restore the set of objects and restart DB2. With this scenario, you will restore both the DB2 data and the log. Since the log is consistent with the data, the point-in-time recovery scenario requires only a normal DB2 restart. In-flight units of recovery will be backed out just as with any normal DB2 restart. After such a restart, the data will represent committed units of recovery at the time logging was initially suspended.

7.8.8 Point-in-time recovery considerations

Your strategy should be to avoid a point-in-time recovery if possible, but also to provide a process that allows it to be performed when necessary. If one must be done, then choose the most effective recovery scenario consistent with your requirements. Following are the considerations for the five options previously discussed:

1. Point-in-time recovery using user-written application programs

   This is a preferred approach among users, when possible. It has the following benefits:

   - There is little or no disruption to the user. Data that has not been corrupted will be available to the user. (However, the user may see erroneous data prior to the recovery.)
   - There is no loss of data entered between the time the data contamination was introduced into the system and the time the contaminated data was corrected. Fewer processor resources are likely to be required than when using either of the other techniques.

   Remember that this is an ideal scenario and not a rigorous one that can be documented and tested. You must be prepared to reset your system by doing the point-in-time recovery when a “programming fix” is not possible or practical.

   Application programming may *not* be able to repair Lawson system data; if Lawson defects exist, other point-in-time recovery techniques may be the only alternative.

2. Point-in-time recovery using DB2 utilities

   This scenario is preferred over the “point-in-time recovery using Dump/Restore utilities” scenario when few tablespaces and indexes are to be recovered. However, the recovery of the number of tablespaces and indexes in a Lawson system may imply an outage of many hours, making this scenario potentially impractical. If you believe that this scenario may be workable in your environment, run a benchmark to assure that your availability requirements can be met.

3. Point-in-time recovery using dump/restore utilities

   The issue regarding this scenario is the number of tablespaces and indexes that must be recovered to an established point of consistency. As the number of tables and indexes to be recovered grows, dump-restore may become the practical alternative.

   Dumping packs and restoring data (using features like FlashCopy or SnapShot) is faster than a recovery-based scenario *if the regularly scheduled dumping activities and database non-availability can be tolerated*. Note that recovery is required only when errors occur, while backup occurs on a scheduled basis even if no errors ever occur.

The major disadvantage to this scenario is that the dumping of the data is disruptive to the user and occurs on a regular basis (usually daily). The Lawson system likely must be stopped in order to dump data that is consistent. Other applications must also be stopped if they are affected by Lawson being unavailable.

An additional disadvantage (affecting all scenarios to some degree, but particularly noticeable in this one) is that work is lost when data is reset to a prior point of consistency. For example, with a once-per-week backup schedule, on average production data for half a week is lost when a point-in-time recovery is executed.

4. Point-in-time recovery using a DB2 conditional restart

   The main benefit of this scenario is that there is effectively no impact on the user in creating the list of candidate points of consistency.

   The time required to actually recover the tablespaces and indexes will likely be somewhat longer than the time required to do the recovery described in “Point-in-time recovery using DB2 utilities” on page 56, because this scenario will likely require more DB2 log processing during the recovery.

   Since this scenario contains a conditional restart, anyone using it *must first practice it*. An improperly done conditional restart has the potential to severely damage your DB2 subsystem.

   In summary, users should consider this scenario when:

   - Having no disruption in defining the candidate points of consistency is of the greatest significance.
   - The long outage to actually perform recovery is acceptable.
   - You are willing to practice conditional restart to develop and maintain the the skills necessary for its success.

5. Point-in-time recovery using suspension of DB2 updating

   This scenario has the advantages of the “point-in-time recovery using dump/restore utilities” scenario with the added benefit that suspended logging is less disruptive to the user than stopping/restarting the DB2 subsystem. Data consistency is assured with this scenario by copying the log in addition to the data, and then executing a normal DB2 restart.

   At the time of the writing of this publication, this "SET LOG SUSPEND/RESUME" feature is being evaluated by some as the basis for their off-site disaster recovery support.

7.9 Other recovery considerations

Due to the fact that the ERP environment causes significant attention to be paid to your point-in-time recovery strategy, the previous section of this book went into detail on that subject. However, you have other recovery considerations. Specifically you must also address:

- Recovery to currency

  Recovery to currency focuses on how you would handle a hardware failure, like the loss of a DASD device.

- Disaster recovery

Disaster recovery addresses how you would handle the loss of your computing center.

7.9.1 Recovery to currency

From the perspective of the ERP environment, recovery to currency considerations are the same as for the non-ERP environment. If you are an experienced DB2 for OS/390 user, your present recovery to currency strategy can be applied to your Lawson ERP environment.

If you are a new user of DB2 for OS/390, you will want to do the following:

- Attend classes focused on training in the use of the DB2 recovery/restart utilities.
- Study the DB2 Utility Guide and Reference focusing on the RECOVER and COPY utilities.
- Study the DB2 Administration Guide focusing on the section that addresses Operation and Recovery.
- We suggest that you periodically attend either local or national user group meetings. They frequently have speakers addressing recovery-related topics.

7.9.2 Disaster recovery

From the perspective of the ERP environment, disaster recovery considerations are the same as for the non-ERP environment. If you have disaster recovery procedures that address your current DB2 environment, they will likely address your Lawson ERP disaster recovery requirements. If you do not presently have DB2 disaster recovery procedures, you will want to evaluate the following potential starting points for disaster recovery support:

- Disaster recover using dump/restore

  This is a frequent starting point for disaster recovery support. The scenario “Point-in-time recovery using dump/restore utilities” on page 57 could also provide a starting point in addressing your disaster recovery requirements.

- Documented disaster recovery scenario

  See your DB2 Administration Guide. The index will refer you to a section on “preparation” for disaster recovery, and a disaster recovery “scenario”. If you ship off-site copies of both your image copies and archive logs, the documented scenario will enable you to recover to the last completed DB2 unit of recovery on the last archive you sent off-site. The scenario is popular; however, it does require practice.

- Disaster recovery with additional hardware

  This is a broad topic that is widely varied in both user requirement and scenario implementation. See “Point-in-time recovery using suspension of DB2 updating” on page 60 for a scenario that could also provide a starting point in addressing your disaster recovery requirements. This scenario will require high-speed hardware to get copies of your DB2 log and data off-site.

Chapter 8. Problems we encountered

This chapter describes problems we encountered during the installation process and the solutions we used to resolve them. Many of these problems occurred because it was our first time doing the installation. We include them here to assist you in case you experience the same problems or confusion with names.

1. Permissions problems

   The first steps are done with user root. If envsetup runs successfully, Lawson will have set up the profile for user ID lawson and file permissions correctly. Do not go back to root to get around permissions problems; instead, solve the problem and run as Lawson. Do not bypass, as this will cause more difficulties in the long run.

2. Access to DB2 Connect from the Lawson user ID

   When you install DB2 connect, the install user ID (the default is db2inst1) is the only user with access to DB2 Connect. You must make changes to the user lawson profile so that user lawson can access DB2 Connect. Add the following statement to the .profile of user ID lawson:

   ```
   . /home/db2inst1/sqllib/db2profile
   ```

   Note: There must be a space between the . (period) and the / (slashmark).

3. Using DB2 Connect V6 on a system that had DB2 Connect V5 installed

   When we issued the DB2 command we were using the V5 version. We had to deinstall V5 and V6, and remove the user IDs db2as and db2inst and their home directories. We then had to reinstall V6 to get the correct access.

4. Installing the FixPak for DB2 Connect

   The FixPak file 465423b_tar is a very large file that contains all the DB2 UDB fixes as well.

   Using the instruction smit software installation and maintenance menus, we were able to upgrade only DB2 Connect v6.1.0.0 to V6.1.0.3.

5. Getting DB2 Connect to connect to the DDF port on DB2

   We encountered confusion with names in the following areas:
   - How to set up DB2 connect - all the catalog commands
   - How to set the variables in the IBM file in /erp/lawson/test directory

   See Chapter 5, “Moving the database to DB2 on OS/390” on page 29, for our detailed explanation.

6. DB2 failed with an `out of resource` message.

   The first time we tried to load the data to DB2, the load failed. When we reviewed the console log, we saw that DB2B was out of temporary tablespace. We had to add two 4 K temporary tablespaces for DB2.

   The job we used to do this is listed in Appendix F, “Job to add temporary tablespaces” on page 95.

7. Telnet terminal type

   To get a readable view of the Lawson user interface, we had to change the terminal emulator from VT420 to VT100. Another suggestion was to use PT80-E.

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8. DB2 driver

   We knew we had to get the Lawson DB2 driver from the Lawson Web site, but first we had to obtain a special Lawson user ID and password to access the file.

9. Using the laenv command

   We were unsure what we had to define and enter for tablespaces when we set up the definitions for laenv.

   See 5.4, “Setting up the Database definitions” for our detailed setup.

10. Locating the logs

    Make sure that you review all the logs when each step of the installation process completes.

11. Determining if DB2 on S/390 tables were created

    The reorg process in the database maintenance option in the laenv program creates the tables on S/390. If you make changes to any of the definitions, you have to go back to the build process before running the reorg.

    We used the SPUFI command to verify that the tables were being created in DB2.

    SELECT * from SYSIBM.SYSTABLES where tablespace is BIGSPACE.

12. Large vtocs

    When many indexes are created which are small VSAM files, it is possible that you will fill up the VTOC before filling up the DASD space available. In our case we created a VTOC with 150 tracks. Review your VTOC space after you have completed your installation.

13. Compiles

    We thought the compile step worked, but it did not because we did not have the permissions set correctly. The compile step takes about 4 to 5 hours. You can monitor the compile process with the command `qstatus |more`.

    We had 947 compiles to execute. You see the compiles executing from the first job to the last. The `qstatus |more` command shows, at the top of the output file, the jobs that are executing and those that are left to run. We needed to have the compiler license daemon running in order for the compiles to work.

    We did not have the license for the C compiler; we only had the runtime, and it worked.

14. HEAP parameter

    We found that to load the training data successfully we had to enlarge the HEAP parameter. This is done as a db2 command line entry. If you are already connected to DB2, you can issue the command:

    ```
    db2 => update dbm cfg using  DRDA_HEAP_SZ 4096
    ```

    Note: Although we read in the Lawson documentation that this parameter did not apply to DB2 on OS/390, we found the default was not large enough in our case.

15.DB2 Connect error

We received the following DB2 Connect error message when we tried to access the incorrect instance name on the S/390 host.

```
dSQL30061N  The database alias or database name "DB2Q  " was not
found at the remote node.  SQLSTATE=08004
```

Appendix A. Installation questionnaire

Questionnaire for the Technical Readiness Assessment for Lawson Insight Applications using DB2 for OS/390

This document lists sample questions and topics that you would discuss with the IBM Sales Representatives (S/390, RS/6000, and/or ERP), the IBM Client Manager, and the customer who is planning to install Lawson Insight Applications on an RS/6000 (AIX) using DB2 for OS/390 as the database server. The answers to these questions will be used by the Engagement Manager to determine the action items to be handled to complete the preparation phase. Several questions marked with *** are considered to be very important, based on early customer experiences. Note that installation of the applications on NT or other UNIX servers is not covered in this checklist.

The following topics form the basis of the questionnaire and subsequent Statement Of Work.

- Database layer (S/390 - OS/390)
- Application layer (RS/6000 -AIX)
- Presentation layer (client - PC considerations)
- Lawson Insight Applications
- Network
- Database (DB2)
- Security
- Installation skills
- Systems management
- Staffing
- Project planning and tracking
- Post-installation activities

Database layer - S/390 platform

Question	Comments if No	Action if No
Is your S/390 system running OS/390 V2R6 (or later)?	OS/390 V2R6 or later is required for Lawson Insight Applications.	
Is there enough processor power?	The S/390 load comes from DB2 processing. A capacity modeling tool is being developed by the IBM Lawson Insight Competency center. See the sizing section that follows.	

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Do you have enough S/390 memory?	A memory upgrade might be needed. The same modeling tool, that will be used to estimate processor capacity, can help determine the amount of memory needed by Lawson Insight. In general, DB2 performance is enhanced when large amounts of memory are available for its use (buffers). Refer to the Sizing section that follows.	
Do you have enough DASD (for DB2 tables and indexes)?	Lawson Insight typically defines a large number of DB2 tables. The amount of user data needs to be determined. Refer to the database question in the Sizing section.	
Do you have large VTOCs?	Because of the large number of DB2 tables and their index files, VTOC sizes often need to be double the usual size.	
Do you have enough SYS1.CATALOG space?	Because a large number of tables are used by Lawson Insight applications, be sure enough space is allocated.	
Have you configured DDF for with DB2?	The application layer will use DB2 Connect to communicate with DB2 on OS/390.	
Will you use an RVA and SnapShot or Enterprise Storage System with Flash Copy?	These devices are ideal for Lawson Insight for spreading out the data on different packs. SnapShot or Flash Copy are ideal for making quick backups for point in time recovery because Lawson Insight handles the referential integrity, not DB2.It is also very beneficial for data placement of the Lawson Insight files. If you are not using RVA or ESS, you will have to spend more time planning the data placement of the DB2 tables and indexes.	
Do you have an archiving facility in place for your DB2 logs?	There are a great many logs created during the initial load process. You should have a tape subsystem available, as well as three to four DASD volumes, if you are archiving DB2 to DASD.	

S/390 sizing information

The sizing should be completed before the Installation Planning Process is initiated.

Question	Comments if No	Actions if No
Do you know which Lawson Insight applications the customer will be running?	This information is used in the modeling tool (contact your IBM Lawson Insight Competency center) to develop memory, DASD, and processor estimates.	
Do you know how many active, concurrent users will be on the system?	This data is necessary for planning purposes. The number of concurrent users (logged-on users actively entering transactions) is key in determining the amount of central storage and processor power necessary to support Lawson Insight Applications on OS/390.	
***Do you understand the ramifications of running background (batch) jobs in prime shift?	Background jobs can create a lot of database activity that can impact interactive users.	
Do you know how many Lawson Insight environments and/or product lines (with a DB2 subsystem) there will be (production, test, Q&A, training)?	Each subsystem, from a S/390 memory and processor capacity standpoint, is separate; thus, the requirements can become cumulative.	
Have you defined the requirement(s) for high or continuous availability?	You will have to consider both AIX and DB2 S/390 backup scenarios.	
Do you know how large the database will be?	Database sizing metrics are available from the IBM Lawson Insight Competency Center. Note: This is a very difficult question to get information on as the answer is dependent on the amount of customer data that will be stored. It will depend on factors such as: How many customer records are there? How many parts in inventory? How many orders per day are processed? How much data is kept online versus archived?	

Application layer (RS/6000 - AIX) considerations

Question	Comments if No	Actions if No
Are you at AIX 4.2 or later?	Lawson Insight minimum requirement.	
Does the RS/6000 have a CD-ROM drive?	Lawson Insight is distributed on CD-ROMs.	
Do you have DB2CONNECT Ver. 6.1?	DB2 Connect V6 is the vehicle for the application server to communicate with DB2 on S/390.	
Do you have enough disk available?	The minimum amount of disk to install the applications will be provided by the sizing..	
Is the C complier available?	Execution time C functions are needed.	
Is MicroFocus COBOL available?	MicroFocus COBOL is needed to complie the applications. If desired, this could be packaged with the applications or obtained seperately.	

Presentation layer (PC client) considerations

Question	Comments if No	Actions if No
Has Windows (9x, or NT) been installed?	These are the operating system options for the client.	
Is there a plan to customize the user's PC?	The Lawson Desktop must be installed on the user’s PCs.	
Has the appropriate Network connection card been configured?	The PC client uses TCP/IP to connect to the application server.	

Lawson Insight Systems (Applications)

Question	Comments if No	Actions if No
Have you architected your interface(s) to legacy systems?	Legacy systems may or may not be replaced by the Lawson Insight applications. If replaced, bridging the data and perhaps parallel runs need to be considered. Some legacy systems may not be replaced and may need to interface with Lawson Insight. Middleware, such as MQ series, may be needed. The logical interfaces need to be defined, the available APIs/interfaces need to be identified and integration architected.	
Have you defined your Lawson Insight Printing requirements and solutions?	Printing is an application server function, but it may be desirable to route printing to the S/390. This would require the appropriate infrastructure and setup of the OS/390 Print Server.	

Network

Question	Comments if No	Actions if No
Is the connection to the LAN of sufficient bandwidth?	DB2 Connect communicates to S/390 over the network, as well as the application layer with the client.	
Is there a “path” to the Internet?	Fix packages and drivers, available on IBM’s and Lawson Software’s Web sites, and will have to be downloaded and applied.	

Database

Question	Comments if No	Actions if No
Are you running DB2 V5 or later on OS/390 today?	DB2 is the only RDBMS that Lawson Insight supports on OS/390. DB2V5 or later is required for Lawson Insight.	
Will you have data other than Lawson Insight application data stored in DB2?	The Lawson Insight Application should have its own DB2 Subsystem. In fact, you may have several DB2 subsystems just for Lawson Insight.	
Do you have DB2 skills, especially DBA, available?	You will need to ensure OS/390 DB2 system programming and DBA skills are readily available. Samples, techniques, and so forth, although technically correct, do not attempt optimization for performance. Sophisticated DB2 skills are necessary for performance enhancements.	
Are you planning to monitor DB2?	You should plan for DB2PM to be used to monitor the database for growth and performance.	
Do you have a DB2 database and tablespace layout for the product line you are going to install?	You may choose to start with one database and one tablespace per product line, which you would then monitor and expand later. The Lawson Center of Excellance can provide alternative sample layouts.	

Security

Question	Comments if No	Actions if No
Do you know how to set up your OS/390 Security Server (RACF) access and DB2 privileges.	You can have minimal security for the pilot. Involve your security administrator.	
Do you know how to handle the expiration of RACF passwords?	DB2 Connect V6 has a new feature to assist in this area.	
Have you reviewed AIX permission bit settings?	Permission bits settings on the application layer can be problematical, you may want to review the Appendix H, “Reducing Lawson UNIX file permissions” on page 101, to ensure the most secure settings.	

Installation requirements

Question	Comments if No	Actions if No
Do you have Lawson Insight install skills?	A Lawson Insight certified installer, though not mandatory, is recommended.	
Do you have AIX (UNIX) skills?	DB2 databases, tablespaces, and so forth are allocated under S/390; the tables are loaded from Lawson utilities under AIX/NT. Applications are installed and run on UNIX.	
Do skills include OS/390 - ISPF and JCL?	These are required for TSO, OS/390 Security Server (RACF) and DB2.	
Are you skilled in Windows (9x or NT)?	This is required for the client.	
Do you have TCP/IP skills on all associated platforms?	TCP/IP is the protocol used to connect all the different layers of Lawson Insight.	
Do you have DB2 DBA skills?	A high level of DBA skills is necessary for Lawson Insight. Tasks range from setting up the database to ongoing monitoring and tuning. There will also be a strong requirement for ongoing monitoring and handling backup and recovery of the DB2.	
Do you have dedicated resources?	Implementation of an ERP is a major project; resource requirements (time and personnel) might be underestimated.	
Do you additional have hardware resources for the installation process?	You will need additional packs for the archiving logs. Memory, paging, and CPU resource can speed up the installation process.	

Systems management

Question	Comments if No	Actions if No
Has High or Continuous Availability been addressed?	Need and expectations might be different. This is a “client/server” implementation, which historically has lower availability than mainframe transaction systems. If the users are migrating from a mainframe transaction system, their availability expectations will be high regardless of their business need. Of course, if the Manufacturing application, for example, is implemented to run a plant operating 24 hours a day, 7 days a week, the need for continuous availability becomes obvious, because of the business need.	
Are there monitoring tools for system availability?	Monitoring Tools will be necessary for both OS/390 and DB2. DB2 PM is recommended.	
Are Systems Outage Analysis-Problem Management tools chosen?	All three components, PC Clients, Lawson Insight Applications, and DB2 should be considered.	
Are reasonable Performance goals set? Has response time expectation been discussed?	As a “client/server” system, response times are longer than “transaction-based systems”, and if the user community is migrating from a transaction based systems, unrealistic expectations may exist.	
Is there a Problem Management System?	Consider all three layers. You have multiple vendors to track problems with (Microsoft for Windows, Lawson Insight for Applications, and IBM for the S/390).	
Is there a Change Management System?	Consider all three layers.	
Is there “Lawson Insight Applications security (password) and Userid” management in place?	End-user security is provided by the Lawson Insight Applications system itself, so new procedures will have to be integrated into the existing security structure.	
Are there backup and recovery procedures?	For both DB2 and the application layer server.	
Is there a Failover plan?	DB2 data sharing and Parallel Sysplex can be used for a failover plan.	

Is there a Disaster Recovery plan?	This will probably be no different than for the rest of the data center.	
Have you considered options such as Support Line, Consult Line etc.?	Remember, the end user is being faced both a new technical solution *and* business processes. This application may introduce new technical usage such as UNIX and DB2.	

Staffing

***It is important to identify the missing skills so that training or support contracts can be arranged. Do not underestimate the time needed for installation and follow-on support.

Question	**Names**	**Action if no one Identified**
DBA (DB2)		
DB2 Systems Programming		
OS/390 System Programming and DASD administration		
AIX (UNIX) application installation and administration		
Client (desktop) administration		
Security administration		
Backup and Recovery		
Network - TCP/IP on all three platforms		
Lawson Insight Customization		

Project planning and tracking

As well as the hardware and software planning that has been described, there is a need to have detailed planning done for the following areas:

Question	Comments if No	Action if No
Is there an overall Project Plan?	A good project plan will be necessary for a successful project.	
Is there an Education Plan?	Although part of any good project plan, special emphasis is given because it is often given low priority. DB2 Database administrator skills are key for Lawson Insight Applications.	
Has an “overall” project manager been identified?	A major key to success is a strong project manager. Remember, in most installations, multiple vendors as well as many customer departments are involved, so there should be one person who has responsibility for coordinating and extracting responsibility from all groups.	
Is there an Installation Plan? Is there a training plan? Is there a test plan? Will there be a pilot project? Is there a migration plan? Is there a physical site preparation plan? Is there a post-installation plan?	These are some of the important parts of an installation plan.	

Questionnaire respondent

Name:	
Date completed:	
Phone and/or e-mail address:	

Appendix B. Frequently Asked Questions (FAQs)

This section covers some frequently asked questions about Lawson Insight II software using DB2 on OS/390.

Q What is an *environment*?

A. It is Lawson Insight's integral unit, most analogous to a S/390 subsystem. One environment shares nothing with another, so you could have two Lawson environments. Why have two Lawson environments? If you are migrating from one Lawson release to another, both releases can exist simultaneously, because they have nothing (code, data and so forth) in common.

Q. What is a *system*?

A. It is the term that describes an *application* system (for example HR, which is the Human Resources system).

Q. What is a *product line*?

A. It is an instance of Lawson Insight applications that exists in one *environment* (server - operating system). In S/390 jargon, a "test system" or a "production system" would be a *product line.*

Q. Can you have more than one DB2 database per product line?

A. No. However, when discussing this answer, be aware that under other RDBMSs, the term *database* means something different than under DB2. You can have multiple product lines per database.

Q. Should your Lawson Insight applications be on their own DB2 subsystem?

A. Lawson (as any ERP) should have its own subsystem (to facilitate the backup/recovery, reorganizations, and other maintenance functions of the database).

Q. How do you separate the test and production environments?

A. Use product lines or separate environments, as appropriate to the installation.

Q. Does the Lawson Insight end user see any difference between Lawson Insight applications using DB2 on the S/390, as opposed to the same applications running on a UNIX or NT system?

A. No. From the end-user perspective, the look, feel, and functionality are all the same, regardless of platform.

Q. With Lawson Insight's three-tier architecture (client, application server, and S/390 as the database server), can the application server reside on the S/390?

A. Presently, Lawson Insight only supports either NT or AIX as an application server when using S/390 for the database server.

Q. Can I use an Oracle for S/390 database with Lawson Insight applications?

A. No, Lawson Insight does not support the S/390 Oracle database.

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Q. How long has Lawson Insight supported the data server using DB2 on S/390?

A. General Availability was December 1999.

Q. Why would customers choose the S/390 to run their Lawson Insight applications?

A. If they can run the ERP application on an existing S/390, there are usually economies gained from the use of existing hardware, software, skills, and MIS infrastructure. The traditional benefits of S/390 of scalability, availability, accessing legacy applications can benefit users of Lawson software.

Q. How do clients connect in a Lawson Insight S/390 environment?

A. Clients connect to the application server via TCP/IP.

Q. How does the application server communicate with the S/390 (DB server)?

A. It communicates via DB2 Connect.

Q. Do Lawson Insight applications exploit Parallel Sysplex?

A. This is not a supported solution at this time.

Q. How easy is it to port from another RDBMS and server to a S/390 DB2 environment?

A. Lawson provides a set of utilities to unload data from one type of database and to load it to another type of database.

Q. Can Lawson Insight for UNIX run under OS/390 UNIX (previously referred as S/390 UNIX System Services)?

A. No, Lawson Insight does not offer such an implementation.

Q. Is data (DB2 Tables) stored in ASCII or EBCIDIC?

A. Data is stored in ASCII (as specified by the appropriate DB2 parameters).

Q. What are the minimum required release levels of the various IBM software products?

A. OS/390 V2R6, DB2 for OS/390 V5.1, AIX 4.2, and DB2Connect V6.1

Q. How is sizing done?

A. Contact the IBM/Lawson International Competency Center.

Q. Is multibyte language support available?

A. International languages are supported, but not the multibyte character set.

Q. Is IBM/Lawson International Competency Center support available?

A. Yes, in Saint Paul, Minnesota.

Appendix C. Setting up DB2 Connect

This appendix describes the steps followed to set up DB2 Connect Enterprise Edition on AIX on an RS/6000 to connect to DDF on DB2 for OS/390.

If the AIX system you are using is new, the default number of licensed users allowed is 2. This may not be adequate to allow DB2 agents to connect to the database server. Use SMIT to change the number of licensed users; remember that the DB2 agents will appear as new users to AIX.

The SMIT menu choices to get to **Change/Show Number of Licensed Users** are:

System Environments-->Change/Show Number of Licensed Users, or you can use the command:

```
smit chlicense
```

You should also be aware that the TCP/IP host name is used as a token in the DB2 command processor; this implies that the maximum length of the name is eight characters, even though TCP/IP allows 32 characters in the name. If your hostname is longer than eight characters, you can add a short alias name as the third parameter in the /etc/services file on the line listing the IP address and the hostname.

C.1 Installing DB2 Connect Enterprise Edition on AIX

To establish connectivity between AIX and OS/390, we installed DB2 Connect Enterprise Edition on AIX using the following steps:

- We mounted the CD-ROM for DB2 Connect Enterprise Edition, Version 6.1 for AIX. If you follow the instructions from *IBM DB2 Connect Enterprise Edition Quick Beginnings Version 6,* CT6DTNA, this will be mounted on mount point `/cdrom`, which is an empty directory you must create. Use the `cd` command to change directory to the CD-ROM mounted directory; `/cdrom` is the name suggested previously.
- We installed the DB2 UDB Enterprise Edition and DB2 Connect by issuing the command `./db2setup` on the CD-ROM file system.

Since we were using TCP/IP, we followed the instructions in Chapter 6 of *IBM DB2 Connect Enterprise Edition Quick Beginnings Version 6*, CT6DTNA.

We then installed the current FixPak, in our case FixPak 1B, which we downloaded from the Web site:
`http://www-4.ibm.com/software/data/db2/db2connect/support.html`

You should use the FixPak that is recommend in the Lawson release notes, usually the latest version.

We followed the instructions in the readme file which we also downloaded. After installing the software we issued the command to bind the new bind files.

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C.1.1 Setting up TCP/IP for DB2 Connect on AIX

The TCP/IP hostname-to-ip address resolution must be done, and the service port to use for communication must be determined. The host name resolution may be done through entries in /etc/hosts or through the use of a domain name server; we placed entries in /etc/hosts, but in a production environment, using name server entries would be a more likely method.

In either case, remember that the name must resolve to the correct *adapter* on the host. Simply using the host name of the S/390 could result in unwanted routings (such as across token ring). Our /390 host is wtsc48.

```
/etc/hosts

10.1.1.100         rs6000a.itso.ibm.com  # local host address token ring
10.1.1.206         wtsc48                # S/390 token ring adapter address
```

You should use the `ping` command to determine that communication is possible. The command used from our application server (rs6000a) is:

```
ping wtsc48
```

We had to identify the services (S/390) TCP/IP port that DB2 was using to listen on (in our case, this was 33326), as follows:

```
/etc/services

lawsonport      33326/tcp   # DB2 connect port for DB2/Lawson
db2cdb2inst1    50000/tcp   # Connection port for DB2 instance db2inst1
db2idb2inst1    50001/tcp   # Interrupt  port for DB2 instance db2inst1
```

Note: The additional entries 50000 and 50001 that were added by the db2setup procedure when the DB2 instance was generated. (We specified 33326 as the connection port for the instance.)

C.1.2 Setting the Profile for users to access DB2 Connect

While installing DB2 Connect you will have a user ID created *db2inst1* that will have authority to issue the DB2 commands.

To allow access for other users, such as `lawson`, you must issue the following complete command to make the DB2 Connect environment:

```
. /home/db2inst1/sqllib/db2profile
```

Note that the beginning period is extremely important in this command; it causes the db2 profile script to be executed *in the same shell* as the one you logged in.Thus, environment variables set in the script hold for the login shell. Also note the space following the initial period; if the space is not there, the period is taken as part of the path name.

We added this command to the .profile file of the user ID lawson so that the command is executed when we login the user ID, instead of our having to issue the command every time we login.You can verify that this has completed correctly by issuing the `set` command. Our profile looks like this:

```
PATH=/usr/bin:/etc:/usr/sbin:/usr/ucb:$HOME/bin:/usr/bin/X11:/sbin:
export PATH
. /home/db2inst1/sqllib/db2profile
```

C.1.3 Customizing DB2 Connect

You can customize DB2 Connect by the following method. Again, ensure you have all the correct information you need because a mismatch in names will cause the connection to fail. It can be difficult to debug this failure.

The information needed is listed in Table 7. These variables are used when you execute the catalog statements in DB2 Connect.

Table 7. DB2 Connect on AIX parameters

Variable	Definition	Value
Node name. If the host name is less than 8 characters, then the node name can be the same as the host name. If it is greater than 8 characters, then choose any name of 8 characters or less.	Host name of RS/6000 system	rs6000a
Remote host name	Host name of S/390 system	wtsc48
DB2 subsystem name	Location name of DB2 database on OS/390	DB2B
DB2 alias name	Alias name of database on RS/6000. For Lawson, this should be the actual database name for this product line on OS/390.	HRTEST1
TSO user ID to connect to DB2 Database alias	RACF user ID	LAWSON1
TSO Password	RACF and sysadm DB2 authority	L1xxxx
Service name	Service name for the port number that is in /etc/services	lawsonport (points to port 33326). You can use either the port number or the service name.

At this point, start the DB2 command line processor by issuing the command:

```
db2
```

Then we issued the four following commands to establish connection:

```
catalog tcpip node rs6000a remote wtsc48 server lawsonport
catalog dcs database HRTEST1 as DB2B
catalog database HRTEST1 as HRTEST1 at node rs6000a authentication DCS
connect to HRTEST1 user LAWSON1 using L1xxxx
```

When connected successfully, you receive the following messages:

```
  Database Connection Information
  Database product      = DB2 OS/390 6.1.1
  SQL Authorization ID  = LAWSON1
  Local address alias   = HRTEST1
```

Note: These are the values we used to test the connection. When setting up the product line, you *must* catalog each DB2 database (Lawson Product Line) that you will use.

Then, to exit the DB2 Command Level Processor, issue the command: `terminate`

8.0.0.1 Checking that the DB2 catalog entries are correct

There are several commands you can use to check your entries if you are having trouble establishing this connection; enter them on the DB2 command line.

To check the node names, issue the following:

```
db2> list node directory
 Node 1 entry
 Node name            =RS6000A
 Comment              =
 Protocol             =TCPIP
 Host                 =wtsc48
 Servicename          =lawsonport
```

To check the database names, issue the following:

```
db2> list database directory

Database 1 entry

 Database alias        = HRTEST1
 Database name         = HRTEST1
 Node name             = RS6000A
 Database level        = 9.00
 Comment               =
 Directory entry used  = Remote
 Authentication        = DCS
 Catalog Node number   = -1
```

To check the DCS entries, issue the following:

```
db2> list dcs directory

DCS 1 entry

Local database name              = HRTEST1
Target database name             = DB2B
Application requestor name       =
DCS parameters                   =
Comment                          =
DCS directory release level      = 0x0100
```

Note: Further information on DB2 Connect is available on the documentation CD-ROM. We found the book *DB2 Universal Database and DB2 Connect - Installation and Configuration Supplement Version 6,* GC09-2857, particularly useful.

Appendix D. Setting up DDF

The following four steps customize DDF:

1. BSDS changes.

   Most DDF parameters are stored in the DSNZPARM module. We used the DSNTIJUZ member in DSN610.NEW.SDSNSAMP to update the DSNZPARM module. One of the steps in the DSNTIJUZ JCL is to update the BSDS information, using the change log inventory utility. To execute the change log inventory you must stop the DB2 subsystem.

   Following is the DSNTIJUZ job step to update the BSDS:

```
//DSNTLOG EXEC PGM=DSNJU003,COND=(4,LT)
//STEPLIB  DD  DISP=SHR,DSN=DSN610.SDSNLOAD
//SYSUT1   DD  DISP=OLD,DSN=DSN610.BSDS01
//SYSUT2   DD  DISP=OLD,DSN=DSN610.BSDS02
//SYSPRINT DD  SYSOUT=*
//SYSUDUMP DD  SYSOUT=*
//SYSIN    DD  *
 DDF    LOCATION=DB2B,LUNAME=SCPDBA1,
        NOPASSWD,RESPORT=33327,PORT=33326
//*
```

2. Define DB2 DDF to VTAM - SYS1.LOCAL.VTAMLST.

   To enable TCP/IP support, you must also define an APPL in VTAM. Do this in SYS1.LOCAL.VTAMLST. The LUNAME keyword must be defined in BSDS, and the LU must be active, prior to starting DDF communications.

   The following shows the APPL definitions in SYS1.LOCAL.VTAMLST:

```
**                                                              **
**      DB2 V6 LU DEFINITION FOR DRDA                           **
**                                                              **
               VBUILD TYPE=APPL
*
SCPDBA1        APPL  ACBNAME=SCPDBA1,                             X
               APPC=YES,                                          X
               ATNLOSS=ALL,                                       X
               AUTH=(ACQ),                                        X
               AUTOSES=10,                                        X
               DMINWNL=25,                                        X
               DMINWNR=25,                                        X
               DSESLIM=50,                                        X
               EAS=509,                                           X
               ENCR=NONE,                                         X
               MODETAB=ISTINCLM,                                  X
               PARSESS=YES,                                       X
               SECACPT=ALREADYV,                                  X
               SONSCIP=NO,                                        X
               SYNCLVL=SYNCPT,                                    X
               VERIFY=NONE,                                       X
                  VPACING=2,                                        X
                  VTAMFRR=NO
```

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3. Define DB2 DDF to RACF.

   DDF uses UNIX System Services to perform TCP/IP services. Some of the UNIX System Services functions that DDF executes require an authorized user with certain privileges. To execute the authorized functions, the user ID associated with the DDF started task must be defined for UNIX System Services as a superuser. To define a user ID as a superuser, you must set the User Identifier (UID) parameter of the RACF user profile to zero.

   To set the UID parameter for your DDF user, you can issue one of the following RACF commands:

   ```
   ADDUSER userid OMVS(UID(0))
   ALTUSER userid OMVS(UID(0))
   ```

   The ADDUSER RACF command adds a new user profile and should be used when creating a new user for DDF. The ALTUSER RACF command changes the RACF profile for the existing DDF user. To check whether your DDF user ID is already correctly defined to RACF, issue the following RACF command:

   ```
   LISTUSER userid OMVS
   ```

   If you specify both a user ID and a group in the RACF Started Procedure Table, ICHRIN03, for the DDF address space, the group must also have a valid UNIX System Services group ID (GID) setting. To define RACF groups to be UNIX System Services groups, use the RACF panels or the following command:

   ```
   ADDGROUP groupid OMVS(GID(n))
   ```

   where groupid is the name of the RACF group associated with the DDF address space, and can be any valid unique identifier.

4. Define DB2 DDF to TCP/IP.

   Part of the DDF customization process is to select port numbers when updating the BSDS. The DDF statement of the change log inventory has been enhanced with PORT and RESPORT values. If PORT and RESPORT are defined, DDF accepts TCP/IP connections from any client that provides valid security information. DB2 also allows outbound connections to other DRDA servers using TCP/IP.

   To define the port numbers in TCP/IP you must update the TCP/IP PROFILE data set. In our case, we used SYS1.TCPPARMS member PROFILE. You must register the TCP/IP port numbers you have specified during DB2 installation or when using the change log inventory utility.

   We defined two port numbers required by our DB2 subsystem, DB2B. In the PORT statement you must use TCP as the protocol, and the name of the UNIX System Services started procedure (in our case, OMVS). Because DB2 uses UNIX System Services services to connect to TCP/IP, the DB2 ports are reserved for the UNIX System Services address space, and not for the DDF address space, xxxxDIST. The PORT definitions are shown here:

   ```
   SYS1.TCPPARMS(PROFILE)
       PORT
         23 TCP INTCLIEN              ;
         33326 TCP OMVS               ; DRDA SQL PORT for DB2B
         33327 TCP OMVS               ; DRDA SQL resync port for DB2BK
   ```

   For more detailed information on customizing DDF, refer to *WOW! DRDA Supports TCP/IP: DB2 Server for OS/390 and DB2*, SG24-2212.

D.0.1 Installing and customizing DB2 Connect Enterprise Edition on AIX

Once DDF is set up, you can install DB2 Connect Enterprise Edition on the RS/6000 and establish the TCP/IP connectivity needed for installing the Lawson software.

Determining parameters

To avoid confusion, you should determine all the information you will need *before* you start this process. Using inconsistent information will prevent you from establishing connectivity, and it will be difficult to determine what is incorrect.

Table 8 lists the parameters we used for our installation.

Table 8. DB2 Connect parameters for AIX

Parameter	Source	Value Used
Protocol	Database Services	TCP/IP
Target Operating System		MVS/ESA to OS/390
Hostname	SYS1.TCPPARMS (PROFILE)	WTSC48 or 9.12.14.207
Port Number	Port number for DRDA in SYS1.TCPPARMS (PROFILE)	33326
Target Database	Location Name	DB2B
Alias Database Name	For DB2 Connect	HRTEST1
TSO User ID	Valid user ID with RACF and DB2 dbadm (use upper case)	LAWSON1
TSO password	RACF password	L1xxxx

Appendix E. DSNZPARMS for DB2

```
//DB2BE    JOB (999,POK),'DB2 V6',CLASS=A,MSGCLASS=T,                    00000001
// NOTIFY=&SYSUID,TIME=1440,REGION=0M                                    00000002
/*JOBPARM L=999,SYSAFF=SC48                                             00000003
//*********************************************************************/000100
00
//* JOB NAME = DSNTIJUZ                                                */00020000
//*                                                                    */00030000
//*    STATUS = VERSION 6                                              */00100000
//*                                                                    */00110000
//* FUNCTION = DSNZPARM AND DSNHDECP UPDATES                           */00120000
//*                                                                    */00130000
//* PSEUDOCODE =                                                       */00140000
//*   DSNTIZA  STEP  ASSEMBLE DSN6.... MACROS, CREATE DSNZPARM         */00150000
//*   DSNTIZL  STEP  LINK EDIT DSNZPARM                                */00160000
//*   DSNTLOG  STEP  UPDATE PASSWORDS                                  */00170000
//*   DSNTIZP  STEP  ASSEMBLE DSNHDECP DATA-ONLY LOAD MODULE           */00180000
//*   DSNTIZQ  STEP  LINK EDIT DSNHDECP LOAD MODULE                    */00190000
//*   DSNTIMQ  STEP  SMP/E PROCESSING FOR DSNHDECP                     */00200000
//*                                                                    */00210000
//* NOTES = STEP DSNTIMQ MUST BE CUSTOMIZED FOR SMP.  SEE THE NOTES    */00220000
//*         NOTES PRECEDING STEP DSNTIMQ BEFORE RUNNING THIS JOB.      */00230000
//*                                                                    */00240000
//*********************************************************************/002500
00
//*                                                                     00260000
//DSNTIZA EXEC PGM=ASMA90,PARM='OBJECT,NODECK'                          00270000
//SYSLIB   DD  DISP=SHR,                                                00280000
//         DSN=DSN610.SDSNMACS                                          00290000
//         DD  DISP=SHR,                                                00300000
//         DSN=SYS1.MACLIB                                              00310000
//SYSLIN   DD  DSN=&&LOADSET(DSNTILMX),DISP=(NEW,PASS),                 00320000
//            UNIT=SYSALLDA,                                            00330000
//            SPACE=(800,(50,50,2)),DCB=(BLKSIZE=800)                   00340000
//SYSPRINT DD  SYSOUT=*                                                 00350000
//SYSUDUMP DD  SYSOUT=*                                                 00360000
//SYSUT1   DD  UNIT=SYSALLDA,SPACE=(800,(50,50),,,ROUND)                00370000
//SYSUT2   DD  UNIT=SYSALLDA,SPACE=(800,(50,50),,,ROUND)                00380000
//SYSUT3   DD  UNIT=SYSALLDA,SPACE=(800,(50,50),,,ROUND)                00390000
//SYSIN    DD  *                                                        00400000
    DSN6ENV    MVS=XA                                                  00410000
    DSN6SPRM   RESTART,                                               X00410001
               ALL,                                                   X00410002
               ABEXP=YES,                                             X00410003
               ABIND=YES,                                             X00410004
               AUTH=YES,                                              X00410005
               AUTHCACH=1024,                                         X00410006
               BINDNV=BINDADD,                                        X00410007
               BMPTOUT=4,                                             X00410008
               CACHEDYN=YES,       <--- WAS NO                        X00410009
               CACHEPAC=32768,                                        X00410010
               CACHERAC=32768,                                        X00410011
               CATALOG=DB2V610B,                                      X00410012
               CDSSRDEF=1,                                            X00410013
               CHGDC=NO,                                              X00410014
               CONTSTOR=NO,                                           X00410015
```

```
                    DECDIV3=NO,                                          X00410016
                    DEFIXTP=2,           <--- NO PARM                    X00410016
                    DEFLTID=IBMUSER,                                     X00410017
                    DESCSTAT=NO,                                         X00410018
                    DLITOUT=6,                                           X00410019
                    DSMAX=3000,          <--- WAS 10000                  X00410020
                    EDMPOOL=13687,       <--- WAS 89513                  X00410021
                    EDMDSPAC=0,                                          X00410022
                    EDPROP=NO,                                           X00410023
                    HOPAUTH=BOTH,                                        X00410024
                    IRLMAUT=YES,                                         X00410025
                    IRLMPRC=IRLBPROC,                                    X00410026
                    IRLMSID=IRLB,                                        X00410027
                    IRLMRWT=60,                                          X00410028
                    IRLMSWT=300,                                         X00410029
                    LEMAX=20,                                            X00410030
                    MAXRBLK=4384,                                        X00410031
                    MAXKEEPD=5000,                                       X00410032
                    NUMLKTS=10000,       <--- WAS 1000                   X00410033
                    NUMLKUS=25000,       <--- WAS 10000                  X00410034
                    OPTHINTS=NO,                                         X00410035
                    RECALL=YES,                                          X00410036
                    RECALLD=120,                                         X00410037
                    RELCURHL=NO,          <--- WAS YES                   X00410038
                    RETLWAIT=0,                                          X00410039
                    RETVLCFK=NO,                                         X00410040
                    RGFCOLID=DSNRGCOL,                                   X00410041
                    RGFDBNAM=DSNRGFDB,                                   X00410042
                    RGFDEDPL=NO,                                         X00410043
                    RGFDEFLT=ACCEPT,                                     X00410044
                    RGFESCP=,                                            X00410045
                    RGFFULLQ=YES,                                        X00410046
                    RGFINSTL=NO,                                         X00410047
                    RGFNMORT=DSN_REGISTER_OBJT,                          X00410048
                    RGFNMPRT=DSN_REGISTER_APPL,                          X00410049
                    RRULOCK=NO,                                          X00410050
                    SEQCACH=BYPASS,                                      X00410051
                    SEQPRES=NO,                                          X00410052
                    SITETYP=LOCALSITE,                                   X00410053
                    SRTPOOL=876,                                         X00410054
                    SYSADM=KARRAS,                                       X00410055
                    SYSADM2=PSOFT2,                                      X00410056
                    SYSOPR1=SYSOPR,                                      X00410057
                    SYSOPR2=SYSOPR,                                      X00410058
                    TRKRSITE=NO,                                         X00410059
                    UTIMOUT=6,                                           X00410060
                    XLKUPDLT=NO                                           00410061
DSN6ARVP            ALCUNIT=CYL,          <--- WAS BLK                   X00410062
                    ARCWRTC=(1,3,4),                                     X00410063
                    ARCWTOR=NO,          <--- WAS YES                    X00410064
                    ARCPFX1=DB2V610B.ARCHLOG1,                           X00410065
                    ARCPFX2=DB2V610B.ARCHLOG2,                           X00410066
                    ARCRETN=0,           <--- WAS 9999                   X00410067
                    BLKSIZE=24576,       <--- WAS 28672                  X00410068
                    CATALOG=YES,         <--- WAS NO                     X00410069
                    COMPACT=NO,                                          X00410070
                    PRIQTY=1200,         <--- WAS 1234                   X00410071
                    PROTECT=NO,                                          X00410072
```

```
                QUIESCE=5,                                          X00410073
                SECQTY=100,           <--- WAS 154                  X00410074
                TSTAMP=YES,           <--- WAS NO                   X00410075
                UNIT=SYSALLDA,                                      X00410076
                UNIT2=SYSALLDA                                       00410077
DSN6LOGP        DEALLCT=(0),                                        X00410078
                MAXARCH=1000,                                       X00410079
                MAXRTU=1,             <--- WAS 2                    X00410080
                OUTBUFF=400,          <--- WAS 4000                 X00410081
                TWOACTV=NO,           <--- WAS YES                  X00410082
                TWOARCH=NO,           <--- WAS YES                  X00410083
                WRTHRSH=20,           <--- WAS 30                   X00410084
                ARC2FRST=NO                                          00410085
DSN6SYSP        AUDITST=NO,                                         X00410086
                BACKODUR=5,                                         X00410087
                CONDBAT=128,          <--- WAS 64                   X00410088
                CTHREAD=200,          <--- WAS 70                   X00410089
                DBPROTCL=DRDA,                                      X00410090
                DLDFREQ=5,                                          X00410091
                DSSTIME=5,                                          X00410092
                EXTRAREQ=100,                                       X00410093
                EXTRASRV=100,                                       X00410094
                IDBACK=80,            <--- WAS 20                   X00410095
                IDFORE=40,            <--- WAS 40                   X00410096
                IDXBPOOL=BP0,                                       X00410097
                LBACKOUT=AUTO,                                      X00410098
                LOBVALA=2048,                                       X00410099
                LOBVALS=2048,                                       X00410100
                LOGAPSTG=0,                                         X00410101
                LOGLOAD=50000,        <--- 9999999                  X00410102
                MAXDBAT=128,          <--- 64                       X00410103
                MON=NO,                                             X00410104
                MONSIZE=8192,                                       X00410105
                PCLOSEN=5,                                          X00410106
                PCLOSET=10,                                         X00410107
                RLF=NO,                                             X00410108
                RLFTBL=01,                                          X00410109
                RLFERR=NOLIMIT,                                     X00410110
                RLFAUTH=SYSIBM,                                     X00410111
                ROUTCDE=(1),                                        X00410112
                EXTSEC=NO,                                          X00410113
                SMFACCT=(1,2,3),                                    X00410114
                SMFSTAT=YES,                                        X00410115
                STATIME=30,                                         X00410116
                STORMXAB=0,                                         X00410117
                STORPROC=DB2BSPAS,                                  X00410118
                STORTIME=180,                                       X00410119
                TBSBPOOL=BP0,                                       X00410120
                TRACSTR=NO,                                         X00410121
                TRACTBL=16,                                         X00410122
                URCHKTH=0,                                          X00410123
                WLMENV=                                              00410124
 DSN6FAC        DDF=AUTO,                                           X00410125
                CMTSTAT=ACTIVE,                                     X00410126
                IDTHTOIN=0,                                         X00410127
                RESYNC=2,                                           X00410128
                RLFERRD=NOLIMIT,                                    X00410129
                TCPALVER=NO,                                        X00410130
```

```
                MAXTYPE1=0,                                              X00410131
                TCPKPALV=ENABLE,                                         X00410132
                POOLINAC=300                                              00410133
    DSN6GRP     DSHARE=NO,                                               X00410134
                GRPNAME=DSNCAT,                                          X00410135
                MEMBNAME=DSN1,                                           X00410136
                COORDNTR=NO,                                             X00410137
                ASSIST=NO                                                 00410138
    END                                                                  01800000
//*********************************************************************
01810000
//* LINK EDIT THE NEW DSNZPARM MEMBER.  PUT LOAD MODULE IN SDSNEXIT.  *
01820000
//*********************************************************************
01830000
//DSNTIZL EXEC PGM=IEWL,PARM='LIST,XREF,LET,RENT',                       01840000
//            COND=(4,LT)                                              01850000
//ADSNLOAD DD  DISP=SHR,                                               01860000
//         DSN=DSN610.SDSNLOAD                                         01870000
//         DD  DISP=SHR,                                               01880000
//         DSN=DSN610.ADSNLOAD                                         01890000
//SYSPUNCH DD  DSN=&&LOADSET(DSNTILMX),DISP=(OLD,DELETE)               01900000
//SYSLMOD  DD  DISP=SHR,                                               01910000
//         DSN=DB2V610B.SDSNEXIT                                       01920000
//SYSPRINT DD  SYSOUT=*                                                01930000
//SYSUDUMP DD  SYSOUT=*                                                01940000
//SYSUT1   DD  UNIT=SYSALLDA,SPACE=(1024,(50,50))                      01950000
//SYSLIN   DD  *                                                       01960000
   INCLUDE SYSPUNCH(DSNTILMX)                                          01970000
   INCLUDE ADSNLOAD(DSNZPARM)                                          01980000
   ORDER DSNAA                                                         01990000
   INCLUDE ADSNLOAD(DSNAA)                                             02000000
   INCLUDE ADSNLOAD(DSNFSYSP)                                          02010000
   INCLUDE ADSNLOAD(DSNJARVP)                                          02020000
   INCLUDE ADSNLOAD(DSNJLOGP)                                          02030000
   INCLUDE ADSNLOAD(DSNTSPRM)                                          02040000
   INCLUDE ADSNLOAD(DSNVDIR1)                                          02050000
   INCLUDE ADSNLOAD(DSNZMSTR)                                          02060000
   INCLUDE ADSNLOAD(DSN3DIR1)                                          02070000
   INCLUDE ADSNLOAD(DSN7GRP)                                           02080000
   ENTRY   DSNZMSTR                                                    02090000
   NAME    DSNZDB2B(R)                                                 02100000
//*                                                                    02110000
//*        CHANGE LOG INVENTORY:                                       02120000
//*        UPDATE BSDS                                                 02130000
//*                                                                    02140000
//DSNTLOG EXEC PGM=DSNJU003,COND=(4,LT)                                02150000
//STEPLIB  DD  DISP=SHR,DSN=DSN610.SDSNLOAD                            02160000
//SYSUT1   DD  DISP=OLD,DSN=DB2V610B.BSDS01                            02170000
//SYSUT2   DD  DISP=OLD,DSN=DB2V610B.BSDS02                            02180000
//SYSPRINT DD  SYSOUT=*                                                02190000
//SYSUDUMP DD  SYSOUT=*                                                02200000
//SYSIN    DD  *                                                       02210000
 DDF    LOCATION=DB2B,LUNAME=SCPDB2B,                                 02210001
        NOPASSWD,RESPORT=33327,PORT=33326                             02210002
//*                                                                    02240000
//*********************************************************************
02250000
```

```
//*   ASSEMBLE AND LINK EDIT DATA-ONLY LOAD MODULE DSNHDECP.           02260000
//*   THE FOLLOWING STEPS ARE NEEDED ONLY IF THE                       02270000
//*   VALUES ARE CHANGED FROM THOSE WHICH ARE SHIPPED.                 02280000
//*******************************************************************
02290000
//DSNTIZP EXEC PGM=ASMA90,PARM='OBJECT,NODECK',COND=(4,LT)             02300000
//SYSLIB   DD  DISP=SHR,                                               02310000
//         DSN=DSN610.SDSNMACS                                         02320000
//SYSLIN   DD  DSN=&&LOADSET(DSNHDECA),DISP=(NEW,PASS),UNIT=SYSALLDA,
02330000
//            SPACE=(80,(50,50,2)),DCB=(BLKSIZE=80)                   02340000
//SYSPRINT DD  SYSOUT=*                                                02350000
//SYSUDUMP DD  SYSOUT=*                                                02360000
//SYSUT1   DD  UNIT=SYSALLDA,SPACE=(800,(50,50),,,ROUND)               02370000
//SYSUT2   DD  UNIT=SYSALLDA,SPACE=(800,(50,50),,,ROUND)               02380000
//SYSUT3   DD  UNIT=SYSALLDA,SPACE=(800,(50,50),,,ROUND)               02390000
//SYSIN    DD  *                                                       02400000
   DSNHDECM    CHARSET=ALPHANUM,                                      X02400001
               ASCCSID=437,            <---- WAS 819                  X02400002
               AMCCSID=65534,                                         X02400003
               AGCCSID=65534,                                         X02400004
               SCCSID=37,                                             X02400005
               MCCSID=65534,                                          X02400006
               GCCSID=65534,                                          X02400007
               ENSCHEME=ASCII,                                        X02400008
               DATE=USA,               <--- WAS ISO                   X02400009
               DATELEN=0,                                             X02400010
               DECARTH=DEC31,                                         X02400011
               DECIMAL=PERIOD,                                        X02400012
               DEFLANG=IBMCOB,                                        X02400013
               DELIM=DEFAULT,                                         X02400014
               MIXED=NO,                                              X02400015
               SQLDELI=DEFAULT,                                       X02400016
               DSQLDELI=APOST,                                        X02400017
               SSID=DSN1,                                             X02400018
               STDSQL=NO,                                             X02400019
               TIME=USA,               <--- WAS ISO                   X02400020
               TIMELEN=0,                                             X02400021
               DYNRULS=YES,                                           X02400022
               LC_CTYPE=,                                             X02400023
               COMPAT=OFF                                              02400024
     END                                                               02650000
//*                                                                    02660000
//*******************************************************************
02670000
//*   LINK EDIT DSNHDECP.                                           * 02680000
//*   DSNHDECP IS A DATA-ONLY LOAD MODULE CONTAINING DEFAULT VALUES   *
02690000
//*   REQUIRED BY DB2 AND APPLICATION PROGRAMS.                     * 02700000
//*   THIS STEP IS CREATED ONLY WHEN THE DEFAULTS SUPPLIED IN       * 02710000
//*   DSNHDECP ARE NOT SUITABLE.                                    * 02720000
//*******************************************************************
02730000
//DSNTIZQ EXEC PGM=IEWL,PARM='LIST,XREF,LET,RENT',                     02740000
//            COND=(4,LT)                                            02750000
//ADSNLOAD DD  DISP=SHR,                                               02760000
//         DSN=DB2V610B.SDSNEXIT                                       02770000
//         DD  DISP=SHR,                                               02780000
```

```
//         DSN=DSN610.ADSNLOAD                                          02790000
//SYSPUNCH DD  DSN=&&LOADSET(DSNHDECA),DISP=(OLD,DELETE)                02800000
//SYSLMOD  DD  DISP=SHR,                                                02810000
//         DSN=DB2V610B.SDSNEXIT                                        02770000
//SYSPRINT DD  SYSOUT=*                                                 02830000
//SYSUDUMP DD  SYSOUT=*                                                 02840000
//SYSUT1   DD  UNIT=SYSALLDA,SPACE=(1024,(50,50))                       02850000
//SYSLIN   DD  *                                                        02860000
   INCLUDE SYSPUNCH(DSNHDECA)                                           02870000
   ORDER   DSNAA                                                        02880000
   INCLUDE ADSNLOAD(DSNAA)                                              02890000
   INCLUDE ADSNLOAD(DSNARIB)                                            02900000
   INCLUDE ADSNLOAD(DSNHDECP)                                           02910000
   ENTRY   DSNHDECP                                                     02920000
   MODE    AMODE(24),RMODE(24)                                          02930000
   NAME    DSNHDECP(R)                                                  02940000
//*                                                                     02950000
```

Appendix F. Job to add temporary tablespaces

```
//DB2BJ    JOB (999,POK),'DB2 V6',CLASS=A,MSGCLASS=T,                  00000001
// NOTIFY=&SYSUID,TIME=1440,REGION=0M                                  00000002
/*JOBPARM L=999,SYSAFF=SC48                                           00000003
//*******************************************************************/000100
00
//* JOB NAME = DSNTIJTM                                              */00020000
//*                                                                  */00030000
//*    STATUS = VERSION 6                                            */00100000
//*                                                                  */00110000
//* FUNCTION = CREATE TEMPORARY FILES FOR DB2                        */00120000
//*                                                                  */00130000
//* PSEUDOCODE =                                                     */00140000
//*   DSNTIC   PROC      FOR INVOKING AMS                            */00150000
//*   DSNTIAD  STEP      PRECOMPILE, ASSEMBLE, LINKEDIT              */00160000
//*                            DYNAMIC SQL PROGRAM                   */00170000
//*   DSNTIAB  STEP      DEFINE BUFFERPOOL AND HIPERPOOL SIZES       */00180000
//*                            WITH ALTER BUFFERPOOL COMMANDS        */00190000
//*   DSNTIAS  STEP      ISSUES A STOP FOR DSNDB07 THEN DROP         */00200000
//*                            ALSO BINDS DYNAMIC SQL PROGRAM        */00210000
//*   DSNTICR  STEP      RUN PROGRAM TO CREATE DATA BASE             */00220000
//*                            FOR TEMPS (DSNDB07)                   */00230000
//*   DSNTTMP  STEP      AMS DEFINES FOR THE TEMPORARY               */00240000
//*                            TABLE SPACE DATA SETS                 */00250000
//*   DSNTIST  STEP      STOP DSNDB07, CREATE TEMPORARY TABLE        */00260000
//*                            SPACES, START DSNDB07                 */00270000
//*******************************************************************/002800
00
//JOBLIB  DD  DISP=SHR,                                               00290000
//            DSN=DSN610.SDSNLOAD                                     00300000
//DSNTIC  PROC                                                        00310000
//* ***************************************************************
*/00320000
//* DIRECTORY/CATALOG AMS INVOCATION INSTREAM JCL PROCEDURE          */00330000
//* ***************************************************************
*/00340000
//DSNTIC  EXEC PGM=IDCAMS                                             00350000
//SYSPRINT DD SYSOUT=*                                                00360000
//SYSUDUMP DD SYSOUT=*                                                00370000
//DSNTIC  PEND                                                        00380000
//DSNTIAD EXEC DSNHASM,MEM=DSNTIAD,PARM.PC='HOST(ASM),STDSQL(NO)'
00390000
//PC.DBRMLIB   DD DSN=DB2V610B.DBRMLIB.DATA(DSNTIAD),                 00400000
//             DISP=SHR                                               00410000
//PC.SYSLIB    DD DSN=DSN610.SDSNSAMP,                                00420000
//             DISP=SHR                                               00430000
//PC.SYSIN     DD DSN=DSN610.SDSNSAMP(DSNTIAD),                       00440000
//             DISP=SHR                                               00450000
//ASM.SYSLIB DD                                                       00460000
//         DD DISP=SHR,                                               00470000
//         DSN=DSN610.SDSNSAMP                                        00480000
//LKED.SYSLMOD DD DSN=DB2V610B.RUNLIB.LOAD(DSNTIAD),                  00490000
//             DISP=SHR                                               00500000
//LKED.SYSIN   DD *                                                   00510000
  INCLUDE SYSLIB(DSNELI)                                            00520000
  NAME DSNTIAD(R)                                                   00530000
```

```
//*                                                                   00540000
//DSNTIAB EXEC PGM=IKJEFT01,DYNAMNBR=20                               00550000
//SYSTSPRT DD  SYSOUT=*                                               00560000
//SYSPRINT DD  SYSOUT=*                                               00570000
//SYSUDUMP DD  SYSOUT=*                                               00580000
//SYSTSIN  DD  *                                                      00590000
  DSN SYSTEM(DB2B)                                                    00600000
  -ALTER BUFFERPOOL (BP0) VPSIZE(2000) HPSIZE(0) VPTYPE(P)            00610000
  -ALTER BUFFERPOOL (BP32K) VPSIZE(24) HPSIZE(0) VPTYPE(P)            00620000
//SYSIN    DD  *                                                      00630000
//*                                                                   00640000
//DSNTIAS EXEC PGM=IKJEFT01,DYNAMNBR=20,COND=(4,LT)                   00650000
//SYSTSPRT DD  SYSOUT=*                                               00660000
//SYSPRINT DD  SYSOUT=*                                               00670000
//SYSUDUMP DD  SYSOUT=*                                               00680000
//SYSTSIN  DD  *                                                      00690000
  DSN SYSTEM(DB2B)                                                    00700000
  -STOP DATABASE(DSNDB07)                                             00710000
  BIND PLAN(DSNTIA61) MEM(DSNTIAD)  ACT(REP) ISOLATION(CS)  -         00720000
       LIB('DB2V610B.DBRMLIB.DATA')                                   00730000
  RUN PROGRAM(DSNTIAD)  PLAN(DSNTIA61) PARM('RC0')  -                 00740000
       LIB('DB2V610B.RUNLIB.LOAD')                                    00750000
  END                                                                 00760000
//SYSIN    DD  *                                                      00770000
   DROP DATABASE DSNDB07 ;                                            00780000
//*                                                                   00790000
//DSNTICR EXEC PGM=IKJEFT01,DYNAMNBR=20,COND=((12,LT,DSNTIAS),
00800000
//   (4,LT,DSNTIAD.PC),(4,LT,DSNTIAD.ASM),(4,LT,DSNTIAD.LKED))
00810000
//SYSTSPRT DD  SYSOUT=*                                               00820000
//SYSPRINT DD  SYSOUT=*                                               00830000
//SYSUDUMP DD  SYSOUT=*                                               00840000
//SYSTSIN  DD  *                                                      00850000
  DSN SYSTEM(DB2B)                                                    00860000
  RUN PROGRAM(DSNTIAD)  PLAN(DSNTIA61) PARM('RC0')  -                 00870000
       LIB('DB2V610B.RUNLIB.LOAD')                                    00880000
  END                                                                 00890000
//SYSIN    DD  *                                                      00900000
   CREATE DATABASE DSNDB07 ;                                          00910000
//*                                                                   00920000
//DSNTTMP EXEC DSNTIC,COND=((12,LT,DSNTIAS),(4,LT,DSNTICR))
00930000
//* ********************************************                      00940000
//*  DEFINE TEMPORARY TABLESPACES                *                    00950000
//*     THESE TABLE SPACES ARE USED FOR TEMPORARY *                    00960000
//*     OR INTERMEDIATE TABLES BY DB2, IN SORTING *                    00970000
//*     FOR ONE EXAMPLE.                          *                    00980000
//* ********************************************                      00990000
//SYSIN DD *                                                          01000000
    DEFINE CLUSTER -                                                  01000001
       ( NAME(DB2V610B.DSNDBC.DSNDB07.DSN4K01.I0001.A001) -           01000002
            LINEAR     -                                             01000003
            REUSE -                                                  01000004
            VOLUMES(TOTLA1) -                                        01000005
            RECORDS(4096 50) -                                       01000006
            SHAREOPTIONS(3 3) ) -                                    01000007
       DATA -                                                        01000008
```

```
   ( NAME(DB2V610B.DSNDBD.DSNDB07.DSN4K01.I0001.A001) -           01000009
                    ) -                                           01000010
  CATALOG(DB2V610B)                                               01000011
                                                                  01000012
DEFINE CLUSTER -                                                  01000001
   ( NAME(DB2V610B.DSNDBC.DSNDB07.DSN4K02.I0001.A001) -           01000002
        LINEAR     -                                             01000003
        REUSE -                                                  01000004
        VOLUMES(TOTLA1) -                                        01000005
        RECORDS(4096 50) -                                       01000006
        SHAREOPTIONS(3 3) ) -                                    01000007
   DATA -                                                         01000008
   ( NAME(DB2V610B.DSNDBD.DSNDB07.DSN4K02.I0001.A001) -           01000009
                    ) -                                           01000010
  CATALOG(DB2V610B)                                               01000011
                                                                  01000012
DEFINE CLUSTER -                                                  01000001
   ( NAME(DB2V610B.DSNDBC.DSNDB07.DSN4K03.I0001.A001) -           01000002
        LINEAR     -                                             01000003
        REUSE -                                                  01000004
        VOLUMES(TOTLA1) -                                        01000005
        RECORDS(4096 50) -                                       01000006
        SHAREOPTIONS(3 3) ) -                                    01000007
   DATA -                                                         01000008
   ( NAME(DB2V610B.DSNDBD.DSNDB07.DSN4K03.I0001.A001) -           01000009
                    ) -                                           01000010
  CATALOG(DB2V610B)                                               01000011
                                                                  01000012
DEFINE CLUSTER -                                                  01000001
   ( NAME(DB2V610B.DSNDBC.DSNDB07.DSN4K04.I0001.A001) -           01000002
        LINEAR     -                                             01000003
        REUSE -                                                  01000004
        VOLUMES(TOTLA1) -                                        01000005
        RECORDS(4096 50) -                                       01000006
        SHAREOPTIONS(3 3) ) -                                    01000007
   DATA -                                                         01000008
   ( NAME(DB2V610B.DSNDBD.DSNDB07.DSN4K04.I0001.A001) -           01000009
                    ) -                                           01000010
  CATALOG(DB2V610B)                                               01000011
                                                                  01000012
DEFINE CLUSTER -                                                  01000001
   ( NAME(DB2V610B.DSNDBC.DSNDB07.DSN4K05.I0001.A001) -           01000002
        LINEAR     -                                             01000003
        REUSE -                                                  01000004
        VOLUMES(TOTLA1) -                                        01000005
        RECORDS(4096 50) -                                       01000006
        SHAREOPTIONS(3 3) ) -                                    01000007
   DATA -                                                         01000008
   ( NAME(DB2V610B.DSNDBD.DSNDB07.DSN4K05.I0001.A001) -           01000009
                    ) -                                           01000010
  CATALOG(DB2V610B)                                               01000011
                                                                  01000012
DEFINE CLUSTER -                                                  01000013
   ( NAME(DB2V610B.DSNDBC.DSNDB07.DSN32K01.I0001.A001) -          01000014
        LINEAR     -                                             01000015
        REUSE -                                                  01000016
        VOLUMES(TOTLA1) -                                        01000017
        RECORDS(1024 50) -                                       01000018
```

```
           SHAREOPTIONS(3 3) ) -                                          01000019
       DATA -                                                             01000020
       ( NAME(DB2V610B.DSNDBD.DSNDB07.DSN32K01.I0001.A001) -              01000021
                         ) -                                              01000022
     CATALOG(DB2V610B)                                                    01000023
                                                                          01000024
                                                                          01010000
//DSNTIST EXEC PGM=IKJEFT01,DYNAMNBR=20,                                 01020000
//     COND=((12,LT,DSNTIAS),(4,LT,DSNTICR),(4,LT,DSNTTMP.DSNTIC))
01030000
//SYSTSPRT DD  SYSOUT=*                                                  01040000
//SYSPRINT DD  SYSOUT=*                                                  01050000
//SYSUDUMP DD  SYSOUT=*                                                  01060000
//SYSTSIN  DD  *                                                         01070000
  DSN SYSTEM(DB2B)                                                       01080000
  -STOP DATABASE(DSNDB07)                                                01090000
  RUN PROGRAM(DSNTIAD)  PLAN(DSNTIA61) -                                 01100000
       LIB('DB2V610B.RUNLIB.LOAD')                                       01110000
  -START DATABASE(DSNDB07)                                               01120000
  END                                                                    01130000
//SYSIN    DD  *                                                         01140000
 CREATE TABLESPACE DSN4K01 IN DSNDB07                                    01140001
        BUFFERPOOL BP0                                                   01140002
        CLOSE NO                                                         01140003
        USING VCAT DB2V610B;                                             01140004
 CREATE TABLESPACE DSN4K02 IN DSNDB07                                    01140001
        BUFFERPOOL BP0                                                   01140002
        CLOSE NO                                                         01140003
        USING VCAT DB2V610B;                                             01140004
 CREATE TABLESPACE DSN4K03 IN DSNDB07                                    01140001
        BUFFERPOOL BP0                                                   01140002
        CLOSE NO                                                         01140003
        USING VCAT DB2V610B;                                             01140004
 CREATE TABLESPACE DSN4K04 IN DSNDB07                                    01140001
        BUFFERPOOL BP0                                                   01140002
        CLOSE NO                                                         01140003
        USING VCAT DB2V610B;                                             01140004
 CREATE TABLESPACE DSN4K05 IN DSNDB07                                    01140001
        BUFFERPOOL BP0                                                   01140002
        CLOSE NO                                                         01140003
        USING VCAT DB2V610B;                                             01140004
 CREATE TABLESPACE DSN32K01 IN DSNDB07                                   01140005
        BUFFERPOOL BP32K                                                 01140006
        CLOSE NO                                                         01140007
        USING VCAT DB2V610B;                                             01140008
//*                                                                      01150000
```

Appendix G. JCL to execute RUNSTATS after the database is loaded

```
//RUNSTAT  JOB (999,POK),'LAWSON    ',NOTIFY=&SYSUID,
//    CLASS=A,MSGCLASS=T,TIME=1439,
//    MSGLEVEL=(1,1)
//RUNSTAT  EXEC PGM=DSNUTILB,PARM=DB2B
//STEPLIB DD  DSN=DSN610.SDSNLOAD,DISP=SHR
//SYSPRINT DD  SYSOUT=*
//UTPRINT  DD  SYSOUT=*
//SYSIN  DD  *
  RUNSTATS TABLESPACE BIGSPACE;
  COMMIT;
/*
//
```

Appendix H. Reducing Lawson UNIX file permissions

This is a version of a document received from Lawson that details the theoretical minimum limits to which you can modify the file permissions on Lawson files and still retain Lawson system integrity.

Be aware that the Lawson Insight Environment install procedures will set the permissions back to what Lawson ships if you re-run the install.

It is suggested that a UNIX script be written to implement these changes.

All Lawson users must be assigned to the UNIX group lawson in the /etc/group file (this allows access via group permissions). It must be their primary group; otherwise, several functions in Lawson will not work correctly where print files, job executions, and program compilations are concerned.

The minimum (most restrictive) file permissions in Lawson are as follows (note that there are files in the $GENDIR/bin directory that need to be run as setuid root):

Perms	Directory	Owner	Group
755	$GENDIR	lawson	lawson
755	$GENDIR/bin	lawson	lawson
755	$GENDIR/bin/*	lawson	lawson
640	$GENDIR/lib/*	lawson	lawson
4755	$GENDIR/bin/execjob	root	lawson
4755	$GENDIR/bin/deljobhst	root	lawson
4755	$GENDIR/bin/getptaccess	root	lawson
4755	$GENDIR/bin/jqcontrol	root	lawson
4755	$GENDIR/bin/ladb	root	lawson
4755	$GENDIR/bin/ladeath	root	lawson
4755	$GENDIR/bin/lafile	root	lawson
4755	$GENDIR/bin/lajs	root	lawson
4755	$GENDIR/bin/latm	root	lawson
4755	$GENDIR/bin/lawsec	root	lawson
4755	$GENDIR/bin/mkhdr	root	lawson
4755	$GENDIR/bin/qcompile	root	lawson
4755	$GENDIR/bin/qcontrol	root	lawson
4755	$GENDIR/bin/qstatus	root	lawson
4755	$GENDIR/bin/queue	root	lawson
4755	$GENDIR/bin/stopjobqueue	root	lawson
4755	$GENDIR/bin/stopqueue	root	lawson
4755	$GENDIR/bin/stopladb	root	lawson

4755	$GENDIR/bin/stoplajs	root	lawson
4755	$GENDIR/bin/stoplatm	root	lawson
700	$GENDIR/a	lawson	lawson
600	$GENDIR/a/*	lawson	lawson
700	$GENDIR/pdlib	lawson	lawson
600	$GENDIR/pdlib/*	lawson	lawson
700	$GENDIR/wslib	lawson	lawson
600	$GENDIR/wslib/*	lawson	lawson
700	$GENDIR/dict	lawson	lawson
700	$GENDIR/elm	lawson	lawson
750	$GENDIR/install	lawson	lawson
777	$GENDIR/template	lawson	lawson
644	$GENDIR/template/*	lawson	lawson
777	$GENDIR/menus	lawson	lawson
644	$GENDIR/menus/*	lawson	lawson
700	$GENDIR/gen/map	lawson	lawson
700	$GENDIR/gen/map/default	lawson	lawson
755	$GENDIR/sybase	lawson	lawson
755	$GENDIR/oracle	lawson	lawson
755	$GENDIR/informix	lawson	lawson
755	$GENDIR/ibm	lawson	lawson
777	$GENDIR/cgi-bin	lawson	lawson

Replace the token <*PRODLINE*> with each of your actual product line names. (These are in *uppercase.*)

777	$LADBDIR	lawson	lawson
770	$LADBDIR/<*PRODLINE*>	lawson	lawson
660	$LADBDIR/<*PRODLINE*>/*	lawson	lawson
666	$LADBDIR/<*PRODLINE*>/reorg.hist	lawson	lawson
777	$LADBDIR/GEN	lawson	lawson
660	$LADBDIR/GEN/*	lawson	lawson
775	$LADBDIR/dict	lawson	lawson
644	$LADBDIR/dict/GEN	lawson	lawson
644	$LADBDIR/dict/<*PRODLINE*>/	lawson	lawson
775	$LADBDIR/sec	lawson	lawson

666	$LADBDIR/sec/*	lawson	lawson
775	$LADBDIR/elm	lawson	lawson
664	$LADBDIR/elm/*	lawson	lawson

Replace the token <*prodline*> from here on with each of your actual product line names. (These are in *lowercase*.)

777	$LAWDIR	lawson	lawson
750	$LAWDIR/pdlib	lawdev	lawson
740	$LAWDIR/pdlib/*	lawdev	lawson
750	$LAWDIR/wslib	lawdev	lawson
740	$LAWDIR/wslib/*	lawdev	lawson
777	$LAWDIR/print	lawdev	lawson
755	$LAWDIR/<*prodline*>	lawdev	lawson
600	$LAWDIR/<*prodline*>/ORACLE	lawson	lawson
600	$LAWDIR/<*prodline*>/INFORMIX	lawson	lawson
600	$LAWDIR/<*prodline*>/SYBASE	lawson	lawson
600	$LAWDIR/<*prodline*>/IBM (7.3.1 and later)	lawson	lawson
755	$LAWDIR/<*prodline*>/pdlib	lawdev	lawson
644	$LAWDIR/<*prodline*>/pdlib/*	lawdev	lawson
755	$LAWDIR/<*prodline*>/wslib	lawdev	lawson
644	$LAWDIR/<*prodline*>/wslib/*	lawdev	lawson
755	$LAWDIR/<*prodline*>/int	lawdev	lawson
644	$LAWDIR/<*prodline*>/int/*	lawdev	lawson
755	$LAWDIR/<*prodline*>/rdlib	lawdev	lawson
755	$LAWDIR/<*prodline*>/sdlib	lawdev	lawson
755	$LAWDIR/<*prodline*>/Admin	lawdev	lawson
755	$LAWDIR/<*prodline*>/obj	lawdev	lawson
644	$LAWDIR/<*prodline*>/obj/*	lawdev	lawson
755	$LAWDIR/<*prodline*>/map	lawdev	lawson
755	$LAWDIR/<*prodline*>/map/default	lawdev	lawson
644	$LAWDIR/<*prodline*>/map/default/*	lawdev	lawson

Replace the token <lang> with each of your locales if you are using translations.

777	$LAWDIR/<*prodline*>/map/<*lang*>	lawdev	lawson
750	$LAWDIR/<*prodline*>/map/<*lang*>/	lawdev	lawson

777	$LAWDIR/*<prodline>*/work	lawdev	lawson
755	$LAWDIR/*<prodline>*/??src	lawdev	lawson
600	$LAWDIR/*<prodline>*/??src/*	lawdev	lawson
644	$LAWDIR/*<prodline>*/??src/*.or	lawdev	lawson
644	$LAWDIR/*<prodline>*/??src/*.sr	lawdev	lawson
777	$LAWDIR/*<prodline>*/bsi750	lawdev	lawson
774	$LAWDIR/*<prodline>*/bsi750/*	lawdev	lawson

If you have the following products - INVENTORY CONTROL, PURCHASE ORDER, MATCHING, REQUISITIONS, add these entries:

777	$LAWDIR/*<prodline>*/hht	lawson	lawson
775	$LAWDIR/*<prodline>*/fax	lawson	lawson
777	$LAWDIR/*<prodline>*/edi	lawson	lawson
775	$LAWDIR/*<prodline>*/bid	lawson	lawson
777	$LAWDIR/*<prodline>*/interface	lawson	lawson
775	$LAWDIR/*<prodline>*/patient	lawson	lawson
777	$LAWDIR/*<prodline>*/vertex	lawson	lawson
777	$LAWDIR/system	lawson	lawson
644	$LAWDIR/system/*	lawson	lawson
644	$LAWDIR/system/license	lawson	lawson
644	$LAWDIR/system/*.cfg	lawson	lawson
644	$LAWDIR/system/*.log	lawson	lawson
755	$LAWDIR/system/termdef	lawson	lawson
644	$LAWDIR/system/termdef/*	lawson	lawson
777	$LAWDIR/system/joblog	lawson	lawson
644	$LAWDIR/system/joblog/*	lawson	lawson
777	$TEMPDIR	root	

If you have installed the additional software packages for EDI:

777	$EDI_ROOT	lawson	lawson
777	$EDI_ROOT/mentor	lawson	lawson
777	$EDI_ROOT/cleoa	root	lawson

You may notice that the $LAWDIR/<prodline> directories are owned by user lawdev, group lawson. You must add this user (lawdev or any user name you

choose in place of lawdev) to your system as a valid login with a UID greater than the value set for LAUAMINUID.

That user ID must have been given Lawson security access to each product line where it will be the owner of the indicated files and directories. The purpose of this is to designate a user other than lawson to compile Lawson COBOL programs.

If security is on, the user lawson cannot compile Lawson COBOL programs because the UID of the user lawson is 80 which is, by convention, less than LAUAMINUID. The user lawson does not then have access in security to compile Lawson COBOL programs (or for that matter to be a job owner to execute them either). Having one user other than lawson allows for tighter file access permissions and yet still allows permission to compile.

All end users accessing Lawson need to be assigned to the UNIX group lawson in the file /etc/group. This allows access via group permissions.

The startqueue script contains a set of the umask to 0. That script may be changed to set the umask to 022. This will insure that the $LAWDIR/<prodline>/obj/* programs will be compiled to produce an object with permissions of 644.

H.0.1 Programs that execute with root authority

The following files in the $GENDIR/bin directory must be installed as setuid root, i.e. 4755 for permissions. This list should be verified against each new release.

```
execjob
deljobhst
getrptaccess   (Universe 2.2.4 or greater)
jqcontrol
ladb
ladeath            (Universe 2.2.4 or greater)
lafile                (Universe 2.2.4 or greater)
lajs
latm
lawsec
mkhdr
qcompile
qcontrol
qstatus
queue
stopjobqueue
stopladb
stoplajs
stoplatm
```

execjob

When a user runs a batch job, for example GL200, an execjob is run which is used to start lacobrts and changes the UID of the lacobrts process to the UID of the user ID that submitted the job. If execjob does not execute as setuid root, then execjob would inherit the UID of the user ID that started the job scheduler (lajs and usually lawson). This will create a problem in viewing print files since print file permissions are set by the user ID that submits the job.

The execjob process also needs to be able to have access rights to change permissions on a print directory so that it can write the print file. This comes into play if a user ID other than the original job owner runs the job.

lajs
lajs needs to be setuid root because within the job scheduler (jobschd), there is the ability to kill a running batch job. This kill option is really doing a kill of the pid and lajs needs the privilege to do so.

latm
If latm is turned on, the online screen lacobrts processes, for example GL00, are owned by lawson. For batch lacobrts processes such as PR160, RW100, and so on, the lacobrts process is owned by the original user ID, and not by lawson. latm needs the privilege of being able to kill the lacobrts if there is a problem, for example, if the program is looping. Therefore, latm has to be setuid root.

ladb, lafile, ladeath
ladb needs to be setuid root because, for example, in an ORACLE database, when a user runs a job, an oradb is started. ladb needs to be able to change the oradb to the UID of the user ID that started the job. lafile handles the data access for Lawson databases and all users share the same open for a given file. ladeath notifies ladb when processes have been completed and need to be killed.

qcontrol, stopqueue, qcompile, and qstatus
qcontrol needs to be setuid root because a kill can be issued in qcontrol to kill any job that is currently compiling. stopqueue needs to be setuid root because it needs the privilege of issuing a kill for the compile server which is run as root. Furthermore, these four programs are linked as part of the COBOL Compile process, so they all need to have the same permissions.

queue
queue needs to be setuid root so that when users submit jobs to compile to the server, they will run as the UID of the person who submits them.

stopladb, stopjobqueue, stoplatm, and stoplajs
These need to be executed as root in order to have the rights to kill off all active lawson processes.

Appendix I. Connectivity options

This appendix discusses considerations for connectivity to the DB2 Database Server. Note that communications is an area of continuous development; additional options may have become available after this writing, or additional developments in the existing options may change these considerations.

In this appendix we concentrate on the connectivity from application servers to a database server. While other communications are at least as important for a large Lawson installation, it was felt that this particular connectivity is most likely to be new for companies performing a migration; we thought that more discussion is necessary than is found in other documents.

Whatever connectivity option is chosen, it must be expected that the connection between the application server and the database server could become a bottleneck as applications usage grows or when more Lawson applications are used.

In this appendix we mainly concentrate on hardware alternatives. Since Lawson uses DB2 Connect and DB2 Connect is based on TCP/IP, software and protocol alternatives are eliminated. Also note that the discussion is theoretical; for information on how to actually implement the connectivity, consult your communications staff, TCP/IP documentation, and the hardware manufacturers' guides. For an example of how DB2 Connect was implemented in a Lawson installation, see Appendix C, "Setting up DB2 Connect" on page 81.

The hardware selections we discuss are:

- ESCON channel adapter
- Gigabit Ethernet
- FDDI
- Fast Ethernet

Note the connection possibilities that are *not* included in the list: Token-ring, normal Ethernet, and telephone line connections were excluded because the speed of these connections is usually inadequate for the amount of data and response requirements of Lawson applications. ATM was eliminated because it is mostly being used as a means of combining small packets in higher-speed backbones of extended networks.

Token-ring is not a viable option for the connection from the application server to the database server. However, it is a viable option for the connection of clients to the application server.

I.0.1 ESCON channel adapter

Channel connection hardware offers very fast transmission. From the view of S/390 systems programmers, it is the easiest to implement. However, it does require a support infrastructure for fiber technology, so you should anticipate building this infrastructure if it is not already in place.

Because channel connections are implemented with a point-to-point approach (application servers only communicate to the database server, not to one another), the highest *aggregate* data rates of all the options are possible. Also

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note that total network congestion plays a small role in response performance; each connection (application server to database server) may be thought of as an independent LAN.

Channel connections may have the highest cost, since the hardware in the application servers is expensive. Because of this, companies that use channel adapters sometimes use a *gateway* approach: some application servers with channel adapters serve as gateways to the database server, and other application servers connect to the gateways using one of the other LAN technologies. This adds complexity to the design, especially in the areas of availability, recovery, and performance.

I.0.2 Gigabit Ethernet

A Gigabit Ethernet LAN with nodes for the application servers and the database server provides high-speed connectivity with adequate bandwidth. This technology does require an OSA-2 adapter on the database server, so systems programmer effort for defining and customizing that hardware is necessary. Gigabit Ethernet networks are implemented with fiber technology, so the fiber support infrastructure noted in I.0.1, “ESCON channel adapter” on page 107 is also necessary for a Gigabit Ethernet.

Communications specialists should also be asked to examine the traffic rates to application servers. Since Gigabit Ethernet is a LAN, it is possible that traffic rates could surpass the LAN capacity; therefore, it might be necessary to use more than one Gigabit Ethernet LAN to support your requirements.

I.0.3 FDDI

Most of the discussion in I.0.2, “Gigabit Ethernet” on page 108 applies to FDDI, but note some differences:

- FDDI is not as fast as Gigabit Ethernet; this has two consequences:
  1. The network capacity required by an *individual* application server may not be met, thus a different option must be chosen.
  2. The network capacity required by *all* the application servers may not be met; multiple FDDI LANs may be necessary.
- FDDI may be implemented with either fiber or copper technology. Building the fiber support infrastructure might not be necessary, or you might plan a later implementation of fiber connectivity.
- FDDI LANs are usually less expensive and less complex than Gigabit Ethernet.

I.0.4 Fast Ethernet

These LANs are marginally adequate for the bandwidth requirements of Lawson applications. You may want to evaluate this alternative as part of a migration strategy if applications use small bandwidths (for example, if applications are to be in “test mode” for an extended period). You may also want to consider this option as a backup for the primary LAN in availability or disaster scenarios.

Fast Ethernet does not require fiber technologies. It is the least expensive of the options to implement, but involves a high risk of inadequate bandwidth.

I.0.5 Connectivity performance

As previously mentioned, the connection could become a bottleneck as applications grow or when more Lawson applications are used. Therefore, measuring the performance of the connection and comparing its usage with capacity should be an ongoing activity. General performance and measurements are subjects outside the scope of this book. However, you should plan to address those subjects. There are many tools and products to assist you; one that you should investigate is Network Traffic Analysis (NTA). For information about NTA, refer to the following Web address:

```
http://www.ibm.com/services/tsm/nta
```

Appendix J. Enterprise Storage Server (ESS)

This section gives the reader who is unfamiliar with the Enterprise Storage Server (ESS) an overview of the device architecture and its unique functions.

J.1 Overview of the ESS

The ESS is a high-performance RAID-5 storage subsystem, and is a member of the Seascape family. It consists of a storage server and attached disk storage devices. The storage server provides integrated caching and RAID support for the attached disk devices. The ESS can be configured in a variety of ways to provide scalability in capacity and performance.

Redundancy within the ESS provides continuous availability. It is packaged in one or more enclosures, each with dual line cords and redundant power. The redundant power system allows the ESS to continue normal operation when one of the line cords is deactivated.

The ESS provides the image of a set of logical disk devices to attached servers. The logical devices are configured to emulate disk device types that are compatible with the attached servers. The logical devices access a logical volume that is implemented using multiple disk drives.

The following host I/O interface attachments are supported:

- SCSI-3 Parallel Interface
- ESCON
- FC-AL
- FICON

On SCSI-3 interfaces, the ESS emulates a variety of fixed-block devices with either 512 or 520 byte blocks. SCSI-3 is, in general, a superset of SCSI-2. A SCSI-3 disk device can be attached to a SCSI-2 initiator, provided the cabling can be interfaced. Many SCSI-2 initiators attach directly to the cabling specified for the SCSI-3 parallel interface, but are referred to as SCSI-2 initiators because they limit their use of the command set to the SCSI-2 subset. Host systems with SCSI-2 or SCSI-3 interfaces can attach to the ESS. The ESS provides multiple SCSI I/O interfaces (busses), each with multiple SCSI targets, and each with multiple disk logical units. The storage provided by the ESS for SCSI interfaces can be configured so that it is shared among multiple SCSI interfaces, if desired.

On ESCON interfaces, the ESS emulates one or more IBM 3990 control units attaching variable size IBM 3390 devices in either 3390 or 3380 track format. The ESS provides multiple ESCON interfaces that provide a set of control unit images, each with multiple disk devices. The storage provided by the ESS for ESCON interfaces is configured so that it is accessible from any ESCON interface.

The ESS is composed of the following components:

The storage server is composed of two clusters that provide the facilities with advanced functions to control and manage data transfer. Should one cluster fail,

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the remaining cluster can take over the functions of the failing cluster. A cluster is composed of the following subcomponents:

- Host adapters - Each cluster has one or more host adapters (HAs). Each host adapter provides one or more host I/O interfaces. A host adapter can communicate with either cluster complex.
- Device adapters - Each cluster has one or more device adapters (DAs). Each device adapter provides one or more storage device interfaces. Disk drives are attached to a pair of device adapters, one in each cluster, so that the drives are accessible from either cluster. At any given time, a disk drive is managed by only one device adapter.
- Cluster complex - The cluster complex provides the management functions for the ESS. It consists of cluster processors, cluster memory, cache, nonvolatile storage (NVS), and related logic.
- Cluster processor - The cluster complex contains four cluster processors (CP) configured as symmetrical multiprocessors (SMP). The cluster processors execute the licensed internal code that controls operation of the cluster.
- Cluster memory/cache - Is used to store instructions and data for the cluster processors. The cache memory is used to store cached data from the disk drives. The cache memory is accessible by the local cluster complex, by device adapters in the local cluster, and by host adapters in either cluster.
- Nonvolatile storage (NVS) - Is used to store a nonvolatile copy of active written data. The NVS is accessible to either cluster-processor complex and to host adapters in either cluster. Data may also be transferred between the NVS and cache.
- Disk drives - Provide the primary nonvolatile storage medium for any host data stored within the ESS Storage devices. They are grouped into ranks and are managed by the clusters.

As a member of the IBM Seascape family, the ESS provides the outboard intelligence required by SAN solutions, offloading key functions from host servers, which frees up valuable processing power for applications. As a comprehensive SAN-based storage solution, the ESS provides considerable management flexibility to meet the fast-paced requirements of the next century.

Among the many factors that make the IBM ESS an ideal solution are:

- Supports all major server platforms including S/390, AS/400, Windows NT, and many varieties of UNIX.
- Fiber channel attachment capability.
- Extensive storage management capabilities through a Web interface used to manage the ESS logical configuration.
- Excellent scalability:
  - From 400 GBs to over 11 Tbs.
  - Simple selection from 16 standard configurations to meet capacity and performance needs.
- Performance optimized to your heterogeneous environment needs.
  - High bandwidth and advanced transaction processing capabilities provide solutions for both online and batch applications.

    - Innovations such as parallel access volumes to reduce resource contention and dramatically improve performance through the elimination or reduction of IOSQ for single-host environments.
    - Multiple Allegiance which allows you to dramatically reduce or eliminate IOSQ time for a multiple-host environment.
    - Performance-enhanced CCW commands.
    - I/O priority queuing—allows users to define priority of application workloads.
    - Custom volumes—the ability to create your own custom-sized logical volumes.
- Availability required to support e-business applications.
    - Business continuity through remote copy services - PPRC and XRC.
    - Rapid data duplication through FlashCopy, providing extensive capabilities to exploit, manage, and protect your information in a 7 x 24 environment.
    - Peer-to-Peer Remote Copy (PPRC)—the ability to create synchronous volume copies via ESCON channels.
    - Extended Remote Copy (XRC)—the ability to create asynchronous volume copies over long distances.
    - Concurrent Copy (CC)—the ability to create volume or data set copies, locally and non-disruptively.
- Storage server availability through redundancy and nondisruptive service with design for no single point of failure or repair.

More information is available through not only the ESS product manuals, but also a suite of IBM redbooks which include:

- *IBM Enterprise Storage Server*, SG24-5465
- *Implementing the IBM ESS in Your Environment*, SG24-5420
- *Implementing ESS Copy Services in a S/390 Environment,* SG24-5680
- *Implementing ESS Copy Services in a UNIX/NT Environment,* SG24-5757

These books are available through the ITSO Web page:

`www.redbooks.ibm.com`

Appendix K. Special notices

This publication is intended to help those who are installing Lawson Insight Software with DB2 for OS/390. The information in this publication is not intended as the specification of any programming interfaces that are provided by DB2 UDB for OS/390 or Lawson Insight Software. See the PUBLICATIONS section of the IBM Programming Announcement for DB2 for more information about what publications are considered to be product documentation.

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Appendix L. Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

L.1 IBM Redbooks

For information on ordering these publications see “How to get IBM Redbooks” on page 119.

- *WOW! DRDA Supports TCP/IP: DB2 Server for OS/390 and DB2*, SG24-2212
- *Implementing DFSMSdss SnapShot and Virtual Concurrent Copy*, SG24-5268
- *Implementing SnapShot*, SG24-2241
- *DB2 for OS/390 and Data Compression*, SG24-5261
- *IBM Enterprise Storage Server,* SG24-5465
- *Implementing the IBM ESS in Your Environment*, SG24-5420
- *Implementing ESS Copy Services in a S/390 Environment*, SG24-5680 (available as a redpiece on the Redbooks Web site)
- *Implementing ESS Copy Services in a UNIX/NT Environment*, SG24-5757 (available as a redpiece on the Redbooks Web site)

L.2 IBM Redbooks collections

Redbooks are also available on the following CD-ROMs. Click the CD-ROMs button at http://www.redbooks.ibm.com/ for information about all the CD-ROMs offered, updates and formats.

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Application Development Redbooks Collection	SK2T-8037
IBM Enterprise Storage and Systems Management Solutions	SK3T-3694

L.3 Other resources

These IBM publications are relevant as further information sources:

- *IBM DB2 Connect Enterprise Edition Quick Beginnings Version 6,* CT6DTNA
- *DB2 Universal Database and DB2 Connect - Installation and Configuration Supplement Version 6,* GC09-2857

These publications, available from Lawson, are also relevant as further information sources:

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- *Lawson Insight II - Installation and Upgrade Manual Version 7.3.1*, December 1999, Document Number EIUM-731U
- *Lawson Insight II - Enterprise Server Version 7.3.1*, November 1999, Document Number EES-731U
- *Lawson Insight II - Database Administration Version 7.3.1*, November 1999, Document Number EDA-731U

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This information was current at the time of publication, but is continually subject to change. The latest information may be found at the Redbooks Web site.

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